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IRES PIEMONTE

Francesca Michielin

Fertility in an Urban Context
A Complex Phenomenon

Preface by Maria Cristina Migliore

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CITTA' DI TORINO

ISTITUTO RICERCHE ECONOMICO SOCIALI DEL PIEMONTE

IRES PIEMONTE is a socioeconomic research Institute that carries out its activity supporting the planning action of the Regione Piemonte and of the other Piedmontese institutions and local bodies.
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The role of Institutes like IRES is to analyse phenomenon pivotal for the regional development. In recent decades the decline of the number of children per couple has been impressive, posing issues about the causes and the effects of such an important change in the life of individuals, families and the whole society. This study aims to focus on this issue in the context of the city of Turin, highlighting the connection between fertility and migration, and between fertility and social conditions. The findings suggest that there are increasing difficulties of having – if not the first child – a second one, especially if the woman doesn't work, an outcome which points out the issue of the conciliation of work and family. On the other hand, it seems that living in the city doesn't affect the probability of having children. These conclusions were reached through an analysis of the life courses of thousands of women and men. This was possible thanks to the Turin Longitudinal Study (SLT), a valuable patrimony of the chief town of Piedmont. We are glad to have shown once more the importance of having an archive of longitudinal data for social research. The research presented here is the result of a fruitful synergy between IRES, SLT, the University of Padua and the Municipality of Turin, and in particular the council departments of Gender policies, Social Services and Registry. This is paradigmatic of the quality of research reached when different resources – regional research, academy, local government – are pooled together to build a complex design of research.

The IRES President
Avv. Mario Santoro

Contents

Having Children in a Big City: Different Social Groups, Different Conditions, Different Behaviours

Edited by Maria Cristina Migliore

What more do we know from this research now than we knew before about having children in Turin?

We found empirical evidences to confirm that in-migrants arrive in Turin with a higher propensity to have children than the autochthones, but quickly adapt their behaviour to those of the locals (Gesano, 1974). That happened in the case of in-migrants from the other Italian regions. Will it happen in the future too? Are foreign in-migrants different? We think that the rate of adaptation will depend on the process of integration: the more quickly they will integrate in the Turin's social system, the quicker they will reduce their propensity to having children, now higher – overall – than that of the locals. A specific analysis of this issue should take into account the different ethnic groups: in fact ethnic groups culturally more similar to the locals are likely to integrate easily, while a deeper cultural gap can hamper integration, preserving the fertility rate to fall, and posing other kind of social problems.

Anyway, let's consider the situation nowadays and the differences between autochthones and in-migrants who arrived from the South and the islands, the Italian areas from which Turin received most in-migrants in the late decades. Looking at what happened could help to anticipate the effects of current migration.

Now the fertility model (in terms of age of giving birth and number of children) between the two seems very similar, while in the 1970s and 1980s in-migrants from the South and the islands had a higher probability of having a second child. At the beginning of the 1990s women similar in age, education and employment, born in the South and the islands or in Turin, had the same propensity to have another child (table 10).

Having the same propensity *ceteris paribus* (equal age, education level, employment status, etc.) doesn't mean that then autochthon women and from the South and the islands – overall – have the same number of children, because the social composition of the two groups is different. In fact, if we look at the descriptive figures (fig. 18, 32 and 33) we notice that in-migrants from the South and the islands still have more children than the autochthones all along the period 1971-2000. In 2000 the difference is smaller, showing that the composition effect is loosing impact. Such a finding could be explained by the fact that the social composition of the women immigrants from the South has become either more similar to the one of the locals ones or has changed in a way that the new mix of groups – both for the immigrants and the autochthones – internally compensate the differences in behaviour among them rendering the two social compositions similar.

The fact that in-migrants from the South and the islands have reduced their fertility rate, becoming more similar to the locals, seems to support the argument that it is difficult to have children in the city. This conclusion is reached also in the analysis of the relation

between fertility and out-migration. It appears that who leaves the city and move towards the suburbs is looking for an appropriate dwelling to have children. But who remains in the city, remains because they think they are able to have children in the city. Therefore the decision of moving out or remaining in the city is a matter of possibility (page 72).

The second important result of the study is about the relation between employment and fertility. The theory of New Home Economics emphasised the increased opportunity costs for employed women compared with those of housewives and the hampering effect of these on fertility. But Michielin's analysis finds that in the 1970s and 1980s the employment status didn't have a significant effect on propensity of having a second child, an effect that becomes positive (not negative as would be expected on the basis of the New Home Economy theory) and significant in the 1990s. This empirical evidence was found also in other recent studies in a different Italian area. The Turin data would show that nowadays a woman who works has a higher propensity to have a second child than a housewife, and the propensity is even higher if the woman is highly educated. But if the husband is a worker, this again hampers fertility. The interpretation we suggest is that double medium-high incomes are now needed – at least in a metropolitan city like Turin – to have a second child. But we can't exclude that it isn't only an issue of economic resources: it is also possible that the difference is linked to the conditions of work and control of them by the workers, allowing various degrees of flexibility in organising the day-to-day familiar tasks.

What Can Social Actors Infer from These Findings?

The kind of research carried out in this study aims to provide some new insights for whoever is interested in social issues. Therefore we propose some reflections on the findings presented here as backcloth of current debate about migration, integration and conciliation of work and family.

These results lead to questions about the children born in in-migrants families, especially in the first period of their permanence. They have more brothers/sisters than autochthon children. How are they growing up? Recent research interests are emerging about second generations. Preliminary evidence shows that second generations of in-migrant are less educated and have a lower social status than autochthones (Piva, 2002). Hence a migration that sometimes seems belonging to the past of the city is in fact affecting the lives of thousands of families. The long standing effects of migrations events on the lives of people and on the society should be taken into account carefully.

Group of in-migrants still have a higher level of fertility than autochthon couples. Are the children born from them going to be less educated as the previous second generations of in-migrants in the 60s?

There is then another significant issue linked to the empirical evidence that highly educated and employed women have a higher likelihood of having a second child. Are economic resources determinant in the decision of having a second child? If money transfers towards families with one child were increased, would couples have another child? Before implementing policies based on a positive answer to this question, it would

be important to develop a wider reflection on this issue. In fact the research presented here couldn't verify (due to the structure of the available data) other potential factors which enter in the decision-making of having a second child. For instance, it can't take into account the conditions at work. It is possible that the higher educated and employed women can have a second child because they control the conditions of their work more than the other women. Therefore they may have more economical resources, but also they may find it easier to combine their job with their family commitments. Lesser educated employed women might in workplaces and in positions with a lower power of negotiation, and suffer from rigidities in the organisation of their day-to-day life. If this is the case, policies on encouraging good practices in the workplaces to favour the conciliation of work and family would sound more appropriate.

Studies from different points of view over this specific issue – the conciliation of work and family in various kind of employments – could be useful to clear the interplay between reproductive projects and job careers, thus unravelling the possibilities of new practices in the organisation of work.

These conclusive reflections point out two main ideas. First it is important to look at the phenomenon of migration as a complex one, developing through time in the stories of the families of migrants and their children, who are growing up in larger families, seeking social integration. The effects of the migration in the 50s and 60s are not over. Secondly the empirical evidence of a change in the role played by work and education in the decision-making of having a second child indicates that now 'working/having children' is not longer an alternative: it is not longer possible to say that for a woman working hampers having children. The matter now is what kind of job they have, not only as women, but also as couples.

The relevance of these issues is linked to the micro level of the quality of life and well-being of the citizens, but not only. On the other hand the rate of fertility of a population has an important impact at a macro level. As pointed out by previous studies (IRES, 2001), the ageing of the population in Piedmont is bringing about transformations in the labour market, in the demand and supply of goods, in the health system, and in the capabilities of innovation. The phenomenon of ageing is caused by the increase of life expectancies and by the decrease in births. The population of the city of Turin is younger than the rest of the region, but this doesn't mean that is not affected by ageing. All the region is characterized by an ongoing decline in fertility since the end of the XIX century, and some areas were the first in Italy to show the decline in births (Livi-Bacci, 1980; La Mendola, Migliore, 1997). The substantial stability in births of the last years shouldn't be interpreted as an inversion of trend too quickly. As Bonifazi at al. points out (Bonifazi, Gesano, Heins, 2001), it could be just an increase due to a recovery of delayed reproduction. Another IRES work provides arguments to be very careful as well. The IRES simulations (Migliore, Abburrà, Gesano, Heins, 2002) show how the rapid decline of births in Piedmont in the 70s and 80s is causing a decrease of women – and therefore potential mothers – in these two first decades of the new millennium. Even an increase in the propensity of having children and/or foreign populations with a higher rate fertility

will not hamper a diminishing number of births in the second part of this decade and next decade, due to the drop in women. It is likely that this phenomenon also involves the city of Turin. Only a very strong immigration (stronger than the one hypothesized in its simulation by Migliore, Abburrà, Gesano, Heins, 2002) can mitigate it. However immigrants shouldn't be considered as a 'taken for granted' resource, as if our economy was competitive in attracting people from other areas: also other regions in the world are organizing themselves to pull human resources from outside (Migliore, 2001).

Therefore, as it is very difficult to change the pattern of the transformation of the population in a few decades due to the inertia of the demographic mechanisms, it is likely that our way of living is about to be deeply challenged and changed by the ageing of the population. Nevertheless it shouldn't give up the efforts to take into account the interplay between the sphere of work and the sphere of affective relations (family) and design a societal organisation in which reproduction of the population is appreciated as a collective phenomenon with important feedback on the functioning of the whole socioeconomic system. In other words, it could be said that a sustainable socioeconomic development should be inclusive of all the population and also allow the reproduction of human resources (Migliore, 2002).

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There has been a very good spirit of cooperation and interplay of roles among us. Maria Cristina promoted the initial research ideas of studying fertility through longitudinal data and then weaved the network of research and institutions to realize the project, while Francesca developed the methodology and the data analysis. We discussed together the hypotheses of the research as well as the presentation of the results. Francesca wrote the following research report whose responsibility has to be recognized as up to her.

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Francesca Michielin and Maria Cristina Migliore

1. Introduction

During the 1990s, an increasing number of countries experienced a lasting drop of the period total fertility rate (TFR) below 1.3, following the leaders Italy and Spain. This new phenomenon, named in the literature *lowest-low fertility*, is likely to spread to many other countries: nowadays, in Europe and East Asia, 14 countries belong to the lowest-low fertility group, and in the next decade, the number is likely to continue to grow.

Consequences of very low and persistent fertility levels may be serious, since declining population size would be salutary from some points of view, but rapid population ageing is likely to pose profound social and economic problems[1]. The issue, therefore, emerges when lowest-low fertility settles as a new phenomenon.

The present work places itself in the framework of lowest-low fertility studies, here considered in a particular context, the urban one.

Also in the past, indeed, the urban context was peculiar, since urban areas such as Vienna, Stockholm and Berlin were the first locations that experienced lowest-low fertility levels[2]. This had been a long time before national fertility levels fell below the 1.3 threshold (*i.e.* in the 1930s). Nowadays, if we compare the Italian TFR with that one of urbanities (such as, for example, Turin, Milan, Udine and Florence), we find that a lower TFR is always associated with the cities[3]. For example, while the Italian TFR for the year 2000 is above 1.2, the levels for the above mentioned cities remain between 1.0 and 1.1.

In general, it is well known that urbanisation and industrialisation have produced many benefits for families and societies, and at the same time they have exerted pressures on the family[4]. In an urban context, women for example are more likely to participate in the labour market, and their role within the family changes. More generally, urban environments and labour markets make it harder to have large families, due to the differences in the cost of living expenses combined with income constraints, as compared to these same aspects in rural areas[5].

Studying urban fertility in Northern Italy is therefore particularly appealing, since we deal with the context of lowest fertility in a country of lowest low fertility. The aim of the present study is thus to analyse fertility choices in the urban context of Turin municipality, *i.e.* in the centre of a relatively large metropolis, also taking into account that other phenomena may influence fertility behaviour.

In doing so, we will employ a particular and innovative data source and advanced statistical tools.

Concerning the kind of data, we will consider the Turin Longitudinal Study, an exhaustive

1. Boongaarts and Feeney (1998).
2. Kohler *et al.* (2001).
3. Ongaro (2002).
4. United Nations (1980).
5. Stark (1991).

source based on the linkage of 1971, 1981 and 1991 censuses and register data. The database provides information on all the people who have been resident in Turin municipality during the period 1971-2000 (in 1971 register was computerised).

For each individual we dispose of the dates of demographic events (such as birth, marriage, in-migration, out-migration and death) as well as information on other characteristics (educational attainment, kind of job, …). Moreover, fertility history has been reconstructed.

As a result, the Turin Longitudinal Study can be considered as a longitudinal and exhaustive database, focused on individuals and on the demographic events they experience during time: thus, the most suitable tools for the analyses consist in event history techniques. In particular, since in some case we hypothesise the endogeneity of different processes, we will also consider models that explicitly take into account the existence of an unobserved heterogeneity component.

The plan of the work is as follows.

In Chapter 2 we focus attention on the general issue of the kind of data we would need for analysing social phenomena, and suggest the Turin Longitudinal Study as an appealing source for the present case. We compare it to other possible sources, even emphasising its positive aspects and drawbacks.

Chapter 3 briefly sketches the urban evolution of the Turin municipality over time underlining the special role of in- and out-migrations in defining the structure of the population. Then, trends in demographic phenomena are presented.

In Chapter 4 and Chapter 5 we analyse specific aspects of fertility in the Turin municipality. Chapter 4 puts particular emphasis on the connections between the deep changes that have occurred over time in fertility behaviour and changes in social factors. The basic questions are: has the link between fertility and other aspects of life changed? If it has, are these changes only due to a change in the composition of women?

Chapter 5 deals besides with the interesting issue of interdependency between fertility choices and out-migration moves. Many elements may indeed discourage family formation in the central city, and this has a consequence on fertility levels attained in the cities. Thus, studying urban fertility it is necessary to take into account how fertility acts on out-migration choices and *vice-versa*.

Finally, Chapter 6 presents a summary of the study and some concluding remarks.

Two appendices are then added, the first presenting some more graphs on fertility trends of specific in-migrant groups, the second thoroughly examining some methodological aspects concerning the explanation of social phenomena. On the one hand, we focus on the theoretical framework that may be used for formulating hypotheses, on the other hand we develop statistical tools necessary for testing hypotheses. In particular, we consider simultaneous equation models as a possible choice for dealing with the endogeneity of the processes.

2. The Turin Longitudinal Study for the Analysis of Fertility

In the introduction we indicated the objectives of this research. To achieve these aims, a crucial point consists on the availability of accurate information on the process under study. This can easily be broken down in two separate steps: first understanding the kind of data we would need for our task, and second considering the data available to understand our problem.

The first question obviously deals with the task of social science in general, and with the best approach for explanation of social changes. The first section of this Chapter is devoted to this argument.

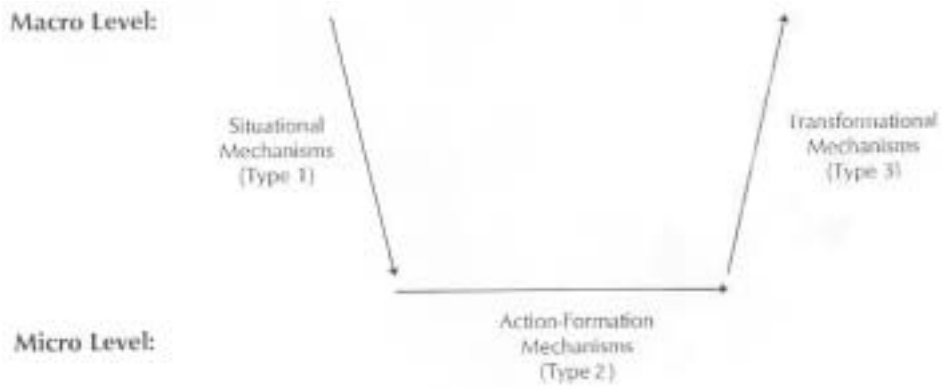
Once the approach to follow has been decided, attention shifts to the available data and the opportunity of using such sources. Each source has positive and negative aspects. With this aim both exhaustive sources and surveys will be presented, to end with the Turin Longitudinal Study, in which the population register and censuses have been linked together for the population resident in Turin up to 1971 at least for a short period.

1. Event History Approach for the Explanation of Social Phenomena

The main task of social sciences is the explanation of social phenomena and not of the behaviour of single individuals. According to Coleman (1994), an analysis can follow two different strategies: first the observation of the behaviour of the system itself; second the analysis of its components. Following Coleman, 'an explanation is sufficiently fundamental for the purpose at hand if it provides a basis for knowledgeable intervention which can change system behaviour' and therefore moving to a lower level than the social system becomes necessary. Indeed, although the effect of any policy is expected to happen on the system level, its implementation must ordinarily occur at lower levels, since the reactions of the individuals to its implementation determine the consequences for the system. In Coleman's approach (exemplified in Figure 1) each change visible to the macro level can be explained by a series of successive macro-to-micro, micro-to-micro, micro-to-macro transformations, and explaining these mechanisms is likely to be more useful than explaining just how the system appears after the policy has been implemented.

Each transformation reflects a different mechanism. Following Hedström and Swedberg (1996), the first one represents the effect that macro level (the context) has on individual level, and can be called the *situational mechanism*. Then the *action-formation mechanism* occurs, and actions are generated starting from individual desires, beliefs, and action opportunities. Finally, individual actions re-acquire a macro dimension,

Figure 1. Social changes and macro-micro components



Source: Hedström and Swedberg (1996)

expressed by a collective outcome, through the *transformational mechanism*. The conclusion is that to explain social changes it is necessary to shift to a deeper level, instead of remaining on the surface.

Also in demography the need of a new paradigm emerged clearly. As pointed out by Courgeau and Lelièvre (1997) in fact, the analysis of demographic phenomena in their 'pure state' (which has been for many years the main task of demographers) requires a strong hypothesis that is very difficult to fulfil: the event under study has to happen in an homogeneous population, *i.e.*, quoting Blayo (1995), a population 'that maintains all its characteristics, and the same characteristics, as long as the phenomenon continues to express itself'.

This postulate has many important implications. First of all, considering that some individuals move into and out of the population, the latter hypothesis implies that they are perfect substitutes of people already in the population, and so that past experience has no value at all. Moreover the need to analyse just one event at a time leads to see other events as interfering events, and the task becomes so to isolate the event of interest in its pure state. Considering another event denies the idea of homogeneous population, because some individuals will have experienced the second event and other not yet, and among people who experienced it, the timing of the event can be different. Although events of life and episodes marked by them are universal, individuals experience transitions in infinitely varied ways, which depend on factors internal to the individual, social factors and situational factors (Willekens, 1999).

Therefore, if the postulate of homogeneity must be fulfilled, the population should be divided into an increasing (and theoretically infinite) number of subpopulations, until the size of each group becomes too small for any analysis, and within which there will be anyway still some heterogeneity which remains unobserved.

The latter issue led to a shift to a new paradigm, in which heterogeneity is explicitly taken

into account as the basic source of information. Under the idea of the *methodological individualism*, 'population dynamics are viewed as the composite effect of life courses' (Willekens, 1999). Heterogeneity is therefore expressed through the characteristics of individuals, both in the macro level (the context in which they live) and in the micro one (that means events experienced, in terms of the exact duration until a state transition as well as occurrence and sequences of events (see Blossfeld and Hamerle, 1988), and exactly the differences among individuals provide information for the process under study. Again, we focus on life courses (Giele and Elder, 1998a) and, as the key building blocks of this new paradigm, on *events* combined in *event histories*.

Each individual's event history can therefore be defined (Courgeau and Lelièvre, 1992) as the result of a complex stochastic process, which develops over time and grows in a specific context (determined by historical, geographical, economic and social conditions). The basic idea of the new paradigm is well expressed by a sentence from Courgeau and Baccaïni (1998): 'in the course of his life, an individual has a complicated trajectory which at any given point in time is dependent on his previous itinerary to date, the information he has been able to accumulate in the past and the conditions prevailing in the society of which he is a member.'

What are the explicit elements determining some differences in the life courses? Giele and Elder (1998a) specify four key elements: the *cultural background*, *i.e.* the social and physical context (recalling the idea of period), the *social integration* or *linked life*, standing for results of various kind of interactions, for example through the cohort, *human agency* as individual goal orientation (that may change according to age) and *timing of lives* as events and trajectories that people experience. In this way, the usual tripartition of age-cohort-period, together with the importance of events experienced during life, helps to explain differences in life courses (Billari, 1999). Time is, in fact, a fundamental concept, and all its dimensions affect life courses (Dykstra and van Wissen, 1999a, distinguish, for instance, biographical, historical and social time).

Therefore, although potentially the population at the beginning is homogeneous in respect of the process being studied, it is in reality heterogeneous because its components differ for cultural background, timing of lives, etc. and the differences grow over time, since social integration and human agency draw different paths in life (Courgeau and Lelièvre, 1997).

We already underlined two basic characteristics of the new approach: first, that the new paradigm has been developed at the individual level, and second that it takes into account also suggestions from the macro level. All these elements can thus be summarised as follows: we are trying to study a population, which is heterogeneous and which heterogeneity evolves over time. Therefore, from the point of view of the choice of data, this stresses the importance of collecting as much information as possible on the differences in the life courses of the entire population of individuals, so as to consider explicitly the most important sources of heterogeneity present in the population.

Modelling the process under study means identifying which elements of heterogeneity we have to consider to explain differences in the analysed process.

2. Data for the Analysis of Demographic Behaviour

In general to study complex behaviours of a given population, complex data are necessary. In event history analysis the ideal dataset is an *exhaustive* observation of the population under study with the aim of providing a *detailed event history* of each of its members.

As exhaustive sources, for demographic phenomena, we can consider: the census, registration statistics and population registers. All these sources allow observation of the total population, but the aspects of event history can not be very detailed. Let us consider for example that we are interested in studying (as in this case) fertility, and we also think that other processes, as out-migration or the occupational career, can interfere with the previous one.

The exhaustive census can only pose a limited number of questions about the event history, and fertility can only be reconstructed using current household composition. The own-children method (Cho, 1973; Goldstein and Goldstein, 1981) has been developed with the aim of studying fertility from current data, and, breaking down the population into subgroups, we can study differential fertility. Clerici (1985) for example studied interrelations between fertility and migration and between fertility and the working career for the Milan province, through 1981 census data.

Since the characteristics of the women at the time of the census define the subgroup to which they belong, and for each subgroup we study the corresponding fertility, we are able to identify an association between phenomena more than understand which factors contribute to low (or rise) fertility.

Moreover, concerning other events of the life course, we dispose of just few points in time. If we consider indeed migration, as pointed out by Courgeau and Lelièvre (1992), we can estimate the number of intercensual migrants, but this estimate does not consider the date of migration, multiple migrations during intercensual period, or returns, resulting in an underestimation of mobility (for an overview of useful Italian census information toward migration see Rossi, 1990). Finally, if data concern only a small area, we can infer only on in-migration, while an out-migration leads to the loss of the observation (right censoring) so that we cannot know even the destination of migration.

Registration statistics represent the basic source for the classic demographic analysis of phenomena taken separately. Marriages, births, deaths, in-migration and out-migration are registered in special forms. Each event is therefore taken into account separately, and we can only understand when these events happened, ignoring also the population under risk of the event. Again, this data is not really useful for our aim.

Data of population registers is besides a good tool for collecting information on different dates of demographic events, although it does do not really take into account changes in occupational or educational status, or various events not officially recorded, such as temporary consensual unions. The key feature is therefore the possibility of determining the population at risk of each demographic event at every moment in time.

Accuracy of population registers (as pointed out by Redfern, 1989) depends on the

function of the register: the greater the number of administrative functions served by a population register, the more accurate and up to date it is likely to be (opportunities for updating and correction are frequent). Conversely a register serving only one or two functions is likely to be inaccurate: though the citizens may be obliged by law to notify changes, there are infrequent references to the register and the citizens may have low incentives to have it updated. The quality of the Italian register is not as high as those of Northern European countries, and the main shortcoming is failure and delays in registering data on changes of address, failure to remove from the registers the names of people who have out-migrated and duplicate registration. Censuses are thus used for checking information and updating them.

Another important drawback is that completeness of data depends on the way it is collected. If for example only the last occurrence of each event is collected, then the dataset has not a really longitudinal perspective and results left censored.

For all these reasons, sometimes surveys are preferable to exhaustive official sources. In fact although they do not allow the exhaustive observation of the population, they can focus attention on some events of particular interest for the researcher, and longitudinally follow the collection of events.

In this respect, two different kind of longitudinal surveys can be reviewed: if individuals are followed since their date of entry into the population at risk, then the survey is called prospective, while if individuals are interviewed once and are asked to give all dates of occurrence of the events studied since their entry into the population at risk, it is retrospective. This distinction recalls the one suggested by Featherman (1980) between longitudinal data and longitudinal designs.

Focusing on retrospective data, the main problem is to disentangle between reality and the reconstruction of reality. As underlined by Scott and Alwin (1998), remembering means reconstructing the process, and during this reconstruction many distortions and reinterpretations in the light of subsequent knowledge and experiences can occur. Rationalisation and denial are only two psychological mechanisms for reconciling people with their fates, and forgetting unimportant things is very common too. Moreover, although when events are reported in the proper order, some *time-aggregation bias* (as called by Willekens, 1999) may occur: telescoping – events are wrongly placed during time – and heaping – abnormal concentration of responses at certain dates, ages or durations – are just two examples. In general, the longer the recall period, the greater the concerns about reliability of this kind of data, although there are important differences by subject matter and salience.

Another important problem concerning retrospective data is the selection of respondents: by definition, respondents belong to the population at the time of the study, and if the phenomenon we are analysing is associated with the probability of being still in the population, this can certainly be puzzling.

On the other hand, this strategy of survey is the cheapest and fastest one for collecting longitudinal information (in one shot survey it is possible to gather information about events happened during a long time span).

A different solution for collecting longitudinal data consists in prospective studies, in which the design itself is longitudinal. In this way information is collected at the time it occurs (Featherman, 1980), and this avoids memory problems and allows the collection of data which would not be memorable at a later point in time but may be strongly correlated with the process under study. Often, however, interviews are status-oriented instead of event-oriented, causing some problems in the analyses.

Prospective studies have many drawbacks: they are expensive, the mere fact of being observed (panel conditioning) can play an important role, and attrition or non response can lead to a biased representation of the population.

The issue of whether interviewing the same people over time affects indeed the essence and quality of respondents answers emerged in some concrete example, as Scott and Alwin (1998) reported. The effect is similar to the one called 'Hawthorne effect', in which the general idea is that behaviour during the course of an experiment can be altered by a subject's awareness of participating in the experiment itself (for a discussion on the Hawthorne effect see Jones, 1992).

The other important problem is attrition or non response, that in panel data is a more serious problem than in a one shot survey, because in each wave some people are lost, and often not randomly.

Summarizing we have seen that both kinds of longitudinal surveys have some problems, and moreover, in case the task is very peculiar (as in this case, in which the idea is to study fertility in an urban context), surveys can not be useful unless they are designed *ad hoc* for the problem under study.

On the other hand, administrative data is too poor to allow an event history approach.

A data source which tries to take advantage of the universality of observation, combining different kinds of sources consists of a record linkage based on censuses and administrative data. The Turin Longitudinal Study is an example of this strategy. As Egidi and Costa (1998) underlined, the reconstruction of biographies can be done linking only administrative data according to an individual code (in case each event registered by public administration is linked to each individual by an identification number, as in Denmark since 1968), or linking register data and census data with this personal reference number (Nordic European countries) or without it (France, England, Italy).

The quality of the linked data can vary widely from country to country (for a detailed analysis – even if not updated – of the situation of West European countries see Redfern, 1989), and in absence of an identification number they can be impracticable because of costs and uncertainties of matching. In Italy, for example, although register data was used since 19th century, linkage is really difficult, because local registers are not interrelated through a central population register, and moreover in some case registers have not been yet computerised. For this reason it is not possible to find in Italy linked data (unless for small areas used in the study of historical demography), with the only exception of the Turin Longitudinal Study (TLS), based on the linkage of census and register data, so as to improve the quality and the quantity of information avaible. The TLS is therefore the only source allowing the study of fertility in an urban context.

With this kind of strategy, indeed, both information on demographic events and on parallel careers (such as educational attainment and occupational status) at the time of censuses are joint together, with the advantage of registering dates of demographic events on continuous time instead of discrete time.
In next sections the TLS will be presented in its main characteristics, focusing then on the linkage, and on the quality of reconstruction of the population we can obtain using this kind of data.

3. What is the TLS?

The Turin Longitudinal Study (TLS) was initiated by the Epidemiology Department of Turin's Local Health Unit for monitoring health inequalities, and in particular to identify possible associations between different types of work and specific causes of death. This is the reason why at the beginning of its life the TLS consisted just in the linkage of 1971, 1981 and 1991 census data with mortality data, without considering other demographic events (Egidi and Costa, 1998).
Later on, the Epidemiology Department of Turin's Local Health Unit decided to extend the scope of the study to promote it in other research fields for example demographic research (Billari *et al.*, 1999). This extension has led to the new TLS.
Linking register data (updated to 31-12-2000) to 1971, 1981 and 1991 censuses, we obtain a longitudinal database. The database consists of all the people who were resident in the Turin municipality for at least a while during the period 1971-2001 (in 1971 the register was computerised). This amounts to information on something like 2 million people: 982,176 males and 993,304 females. For each individual we know all information given by register (date and place of birth, in-migration, out-migration, marriage and death, some information concerning occupational status and educational attainment) and, if the individual was resident in the period of the census and the linkage between census and register succeeded, all information deriving from censuses (that means again age at marriage, occupation and residence at the time of census and 5 years earlier).
The success of the census-register data linkage depends on the quantity of information used to merge different sources, which was quite poor in 1971 (and therefore only the 84.7% of 1971 census data was linked to the register). This while improved in subsequent censuses, allowing the linkage of about 97% of individuals who were interviewed during a census (in detail: 97.8% in 1981 and 96.6% in 1991).
By combining these different sources of information we can proceed to reconstruct the entire fertility history of individuals, the key information which is still missing. On the one hand we can indeed recognise in census data the children of the head of the household that are currently living with their parents at the time of the interview, while on the other, register data provides information on the relationship of each individual with the head of the household. Linking the censuses and register through a complex procedure, we are able to merge each person to his/her parents, connecting then each individual to his/her

children. Moreover, although we are focusing attention on fertility in the urban context, we are also able to reconstruct past fertility for in-migrants, given that children followed their parents in the Turin municipality (therefore in most cases, in-migration does not appear as a left censoring event).

Again, the linkage has been done considering each source separately (register, 1971 census, 1981 census, 1991 census) and comparing then results obtained using each independent source so as to check the quality of the match and to decide, in cases of uncertainty, which kind of source is the most reliable.

Compared to the results of an application of the own children method, TLS allows the crreation, at least theoretically, of a longitudinal database, enriched with other useful information. Each observation corresponds to an individual, for whom we merged all the available information from register and censuses, reconstructing also fertility history. Some information overlapped. Consequently some data quality problems can be better solved by comparing the reliability of different sources and choosing the datum of best quality, *e.g.*: instead of considering education and occupation data in the register, which are of really poor quality, we can focus on censuses.

TLS consists of a huge amount of information. Nevertheless its limitations should be taken into account in order to understand its real potentiality in the analysis of fertility in the Turin municipality. For example, the study does not follow up out-migrated people from Turin. Out-migration is therefore a censoring event for fertility process (causing right censoring), hampering a direct understanding if the demographic behaviour of who leaves Turin differs from those who remained.

Also the left censoring is present, since we do not know anything about people who resided in the Turin municipality previous to 1971. Besides, concerning fertility history of in-migrants, we underlined that in-migration does not necessarily coincide with left censoring, at least if in-migration involved the whole family.

Finally, TLS data quality strongly depends on the quality of original sources and on the success of linkages, which first match censuses and the population register and reconstruct families later on.

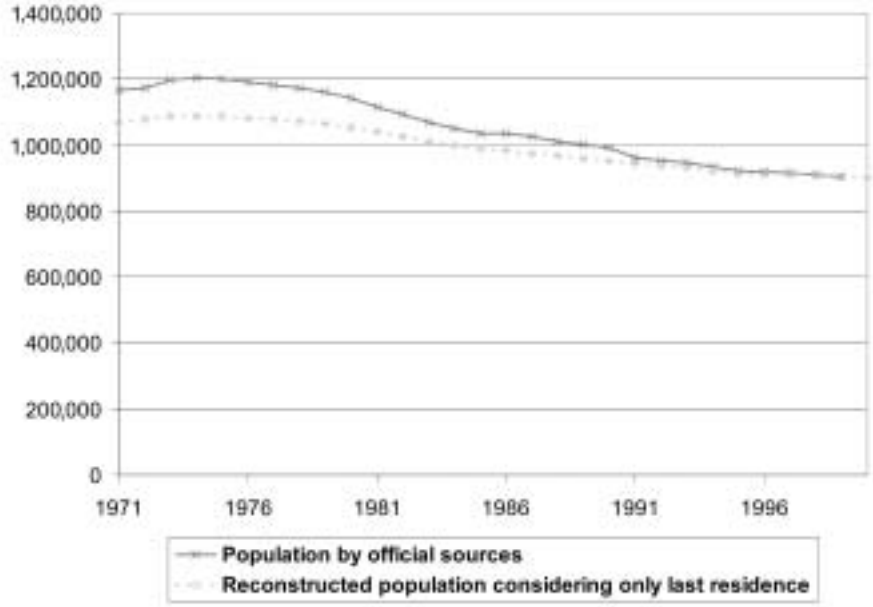
To better understand this issue and to present the main drawbacks of TLS, let us focus on some simple population statistics, as reconstructed through TLS and as given by official statistics.

Figure 2 presents the total amount of the population, which depends on births, deaths and in- and out-migrations. Comparing the lines of the population obtained by reconstruction and population resulting from current statistics, we note that the dashed line (which represents the reconstruction of the population by the 31st December 2000 register) is smoother and lower than the solid line.

Smoothness depends at least partially on the fact that in the reconstruction there are no corrections in correspondence to censuses, while on the contrary current statistics are periodically overhauled.

But the most puzzling thing is that the reconstructed population is always smaller than the population reported in current statistics, and the difference between sources

Figure 2. Population from current statistics and from reconstruction

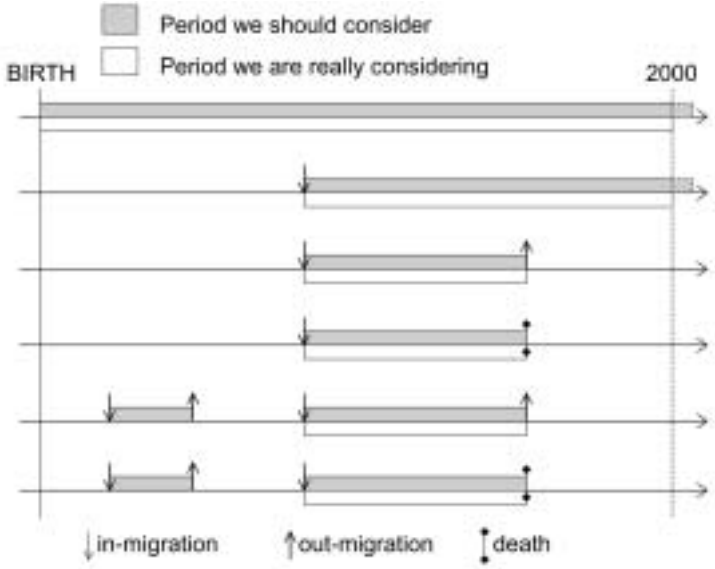


approaches zero when we consider recent periods, while it grows when past periods are taken into account, reaching really high levels at the beginning of 1971.

Indeed, although the population register is a permanent database in which information is collected and remains also after death, in reality some events are lost over time. Computerization implied some limitation in the kind of event collected. In the case of the Turin register, the date of each event is overwritten if another event of the same kind occurs. This means that the date of marriage is the date of last marriage, the date of in-migration is the date of last in-migration and the date of out-migration is the date of last out-migration (fortunately birth occurs only once during life!). Moreover out-migration and death are seen both simply as a censoring event, and the date is written in one field only. To understand exactly what does it happen, let us consider some possible residence histories (determined by birth, migration episodes and death) and the episodes we are effectively considering when we reconstruct the population. In Figure 3 each episode starts with birth or an in-migration (down arrow), and ends with out-migration (up arrow) or death (vertical line) or on the contrary continues after the end of observation period (which ends at December 31st, 2000).

If during life an individual experiences only one residence episode in Turin then the period we should consider is exactly the same as the period we are really considering in our reconstruction, while if there are more distinct periods, only the last one is taken into account. We still have information on the existence of multiple episodes, at least for people who are not dead yet or out-migrated after in-migration until the end of 2000: in this case the

Figure 3. Example of migration history: period that should be considered and period we are really considering



date of out-migration precedes the one of in-migration, and we know that we missed for sure a residence episode. If people are dead and an in-migration has occurred, then we do not know at all if there have been multiple episodes.

The latter bias affects the computation of fertility, since it leads to an underestimation of the population at risk.

What happens when we consider births occurred in the Turin municipality from resident population?

Figure 4 shows the comparison between reconstructed births and amount of births as reported from current statistics. Also in this case, reconstruction leads to an underestimation of the amount of events occurred, heavier in the past than in recent years. This depends both on the computation of the residence period and on an unsuccessful linkage between children and parents.

Using register data, available information consists of the name of parents of each person, while for censuses the current (relatively to the time of censuses) composition of the family is known. Both information can not lead to a certain match: in the first case, we have in fact to consider that errors in reporting the name of parents or a simple omission of a part of the name can lead to mislinkages, and moreover the fact that names are not unique leads to potential multiple attribution. On the other hand, using censuses, the composition of the household leads to recognise children of the head of the household only if they are living in the same household, and the attribution is not straightforward in some cases (for example: what about the children of the brother of the household? And for sons and daughters who left parental home?).

Figure 4. Births from current statistics and from reconstruction

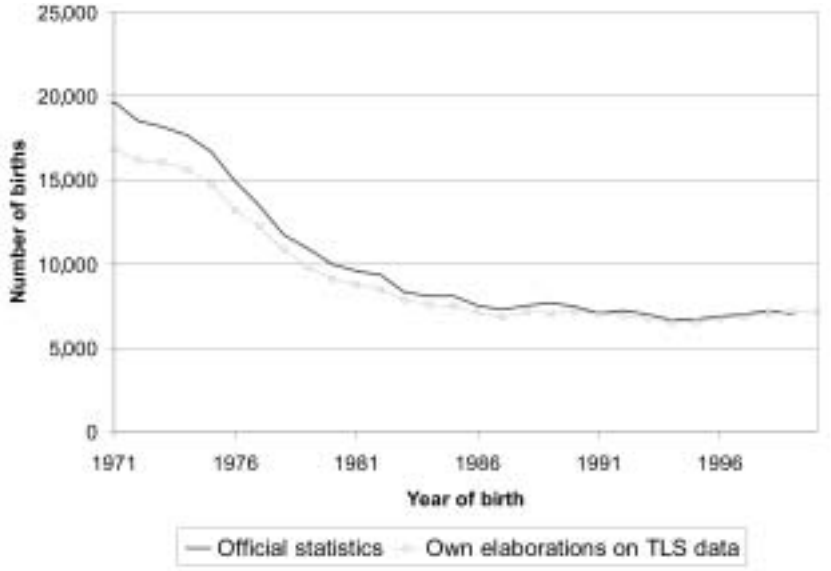
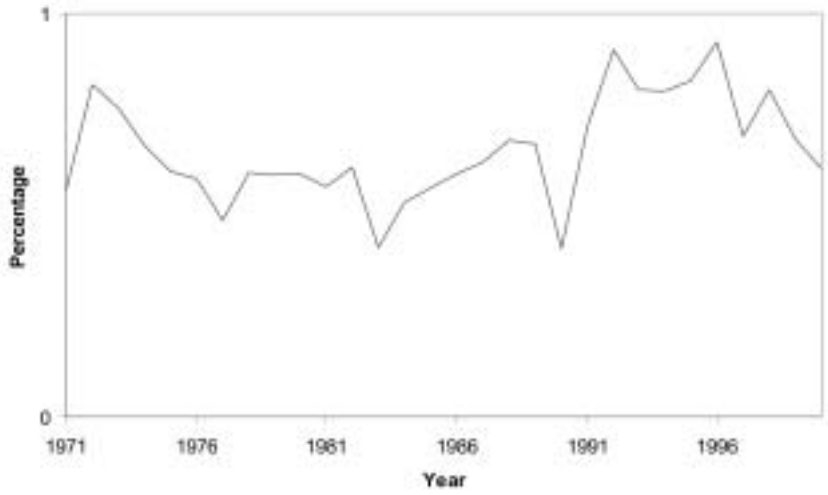


Figure 5. Percentage of unlinked births of children who resided in Turin municipality since birth



All these problems affect reconstruction of families. Preliminary analyses on the quality of this reconstruction (Demaria, 2000) emphasise that whenever a child is linked to his/her parents, linkages obtained using different sources substantially agree with each other (in about 99.8% of times). Moreover, considering just children resident in Turin since birth, and then calculating the proportion of children for whom linkage procedures

were not able to find parents, we may have a clue to the size of underestimate births due to missing reconstruction.
As shown in Figure 5, the amount of children for whom linkage is unable to identify parents is lower than 1%, and therefore consequences on the computation of fertility rates seem to be negligible.
In fact, the problem of inability of reconstructing families may be heavier for the group of in-migrants than autochthon, since the shorter the residence period, the lower the amount of information we dispose of to reconstruct fertility. This may lead to a more strict bias, which in turn does not seem to affect a specific period of time.

4. Discussion

In this Chapter we presented issues concerning the choice of data to study fertility behaviour in the urban context.
First we underlined that to study social phenomena it may be useful to shift our attention from a macro perspective to a micro one, focusing on individuals and on the way they experience the event under study. In this perspective the idea of heterogeneity gains a key role, and to express it explicitly becomes a crucial point. Suggestions for the choice of data source are thus clear: we need micro data, in which events are directly taken into account as a source of heterogeneity, and placed on a time scale.
As a second step we briefly presented various kinds of existing data sources, emphasising the pros and cons, and presenting in TLS detail. This innovative source is an exhaustive source (concerning every individual resident in the Turin municipality for at least a short period of time since 1971) and provides additional information obtained from censuses. Moreover, through a complex linkage each individual is merged to his/her parents, and reconstruction of families is achieved. Therefore, with this data we can study fertility as a longitudinal phenomenon.
Besides the great advantages of such a source, we underlined as well some drawbacks: left and right censoring, problems in reconstructing the real amounts of people and events for a past time period. Through simple statistics we emphasised the main problem is that we dispose only of information on the last residence period, while issues concerning the inability of reconstructing the link between children and parents seem to be of secondary importance. This means that, whenever we compute fertility rates, which are the base of our research, we build the ratio between events and exposure time, both referring to the same time period. Therefore, if we hypothesise that the residence periods we miss are similar (concerning fertility) to the residence periods we observed for other people with similar characteristics, the final results are unbiased.

3. Turin: the Urban Context

To study fertility in Turin, we have first of all to define the context in which fertility plans take place, to understand the specificities of the composition of the population and to follow the evolution of the city.
From the micro perspective, it is indeed well known that economic constraints and changes in values affect fertility behaviour, and the complexity of the situation rises if many fertility models coexist. Turin, as some other large cities in Italy, such as Milan, Naples, Rome, represents a pole of attraction for an incessant flow of in-migrants. These flows changed their composition over time and, as a result, the population of today reflects past flows. Moreover, another process which characterises Turin development is out-migration.
In this Chapter we therefore focus our attention on the evolution of the Turin population, and underline all the elements that will be useful for understanding fertility trends. In section 1 we sketch how the Turin municipality grew during time, underlining the special role of in- and out-migrations in defining the population structure.
In section 2, instead, we focus our attention on demographic phenomena (particularly fertility) as connected with the peculiarity of the urban context under study.
Finally, section 3 presents some concluding remarks.

1. Urbanization and Deurbanization

In studying urbanization in Italy, Golini (1967) focused his attention on the major eleven Italian municipalities (Turin, Genova, Milan, Venice, Bologna, Florence, Naples, Bari, Palermo and Catania) and their evolution during the period 1861 (year of Italian unification) - 1961.
As shown in Table 1, both Rome and Turin gained positions as the most populous cities in Italy; the first for the administrative role of capital city, the second for its increasing industrial importance. Turin indeed, together with Genoa and Milan, is one of the cities in the 'industrial triangle', the major industrial area in North Western Italy (Bonifazi and Heins, 2000). Its development was mainly linked to the evolution of the Fiat car industry, which attracted consistent flows of in-migrants during its economic growth (Golini, 1974).
The first consistent flow of in-migrants in the Turin municipality took place during the 1950s and 1960s, with in-migrants mostly originating from the Southern part of Italy (the same South-to-North flows that interested many other Italian cities; Di Comite, 1985). If we consider the period starting from Italian unification (1861), the Turin population increased from 173.3 thousand inhabitants in 1861 to 1025.8 thousand in 1961, and the strongest increase happened exactly during the 1951-1961 period (see Table 2, from Golini, 1967).

Table 1. Sorting of the 11th Italian biggest cities, by amount of population, period 1871-1961

Municipality	1871	1901	1931	1961
Turin	7	7	4	4
Genoa	5	4	5	5
Milan	2	2	2	2
Venice	8	8	8	10
Bologna	9	10	9	8
Florence	3	6	6	7
Rome	4	3	1	1
Naples	1	1	3	3
Bari	10	9	10	9
Palermo	6	5	7	6
Catania	11	11	11	11

Source: Golini (1967)

Table 2. Resident population by year (in thousands)

1861	1871	1881	1901	1911	1921	1931	1936	1951	1961
173.3	213.4	250.7	329.7	415.7	499.8	590.8	629.1	719.3	1025.8

Source: Golini (1967)

Later on, the in-migrant flow began to decline, strongly in 1974, because of the oil crisis (as confirmed in Figure 6). Indeed, in 1974 the in-migrant flow decreased by 27%, shifting from 37 to 27 thousand units by year. Subsequently, it continued to shrink, reaching 16 thousand in 1989. Only recently the flow overcomes 20 thousand units.

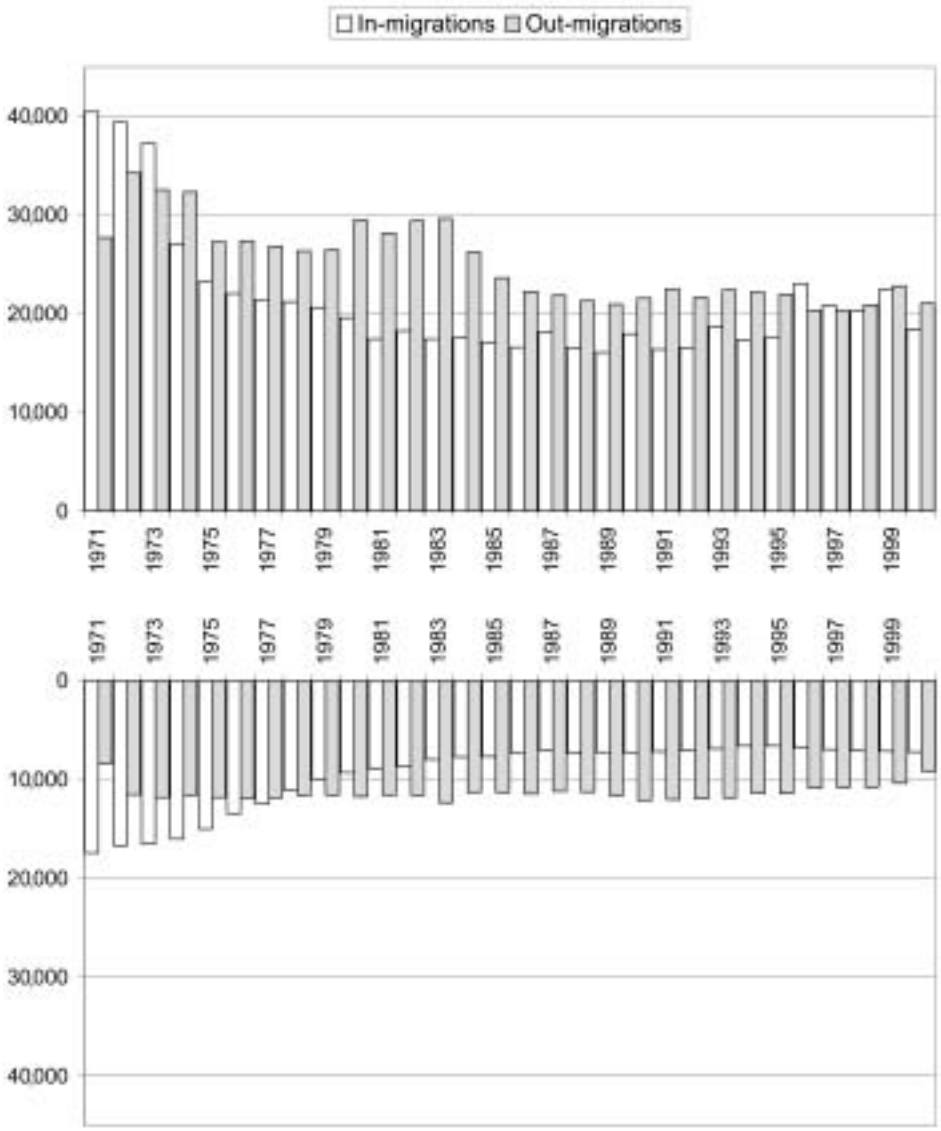
Anyway, the increase and decrease in the population is still strongly affected by migration flows, as shown in Figures 6 and 7.

The shocks due to the oil crisis and to a subsequent period of high unemployment rate (early 1980s and early 1990s) are evident in Figures 8 and 9, representing the amount of in-migrants (all together and broken down by sex) by year and age[6]. Light colours can be associated to high amounts of in-migrants, while dark colours are associated with low flows.

Observing the graphs, we can take into account the composition by age of the flows, confirming the general idea (Rogers and Castro, 1984) that in-migrants are mostly between age 20 and 30, more males than females, and that this phenomenon involves also a component of children. The decreasing trend of the flow of in-migrants affected all the age groups.

6. These kinds of graphs, combining information on age and period, are called Lexis maps in demography. To draw these maps we used 'Lexis' program, a freeware package for plotting Lexis maps (Andreev, 1999).

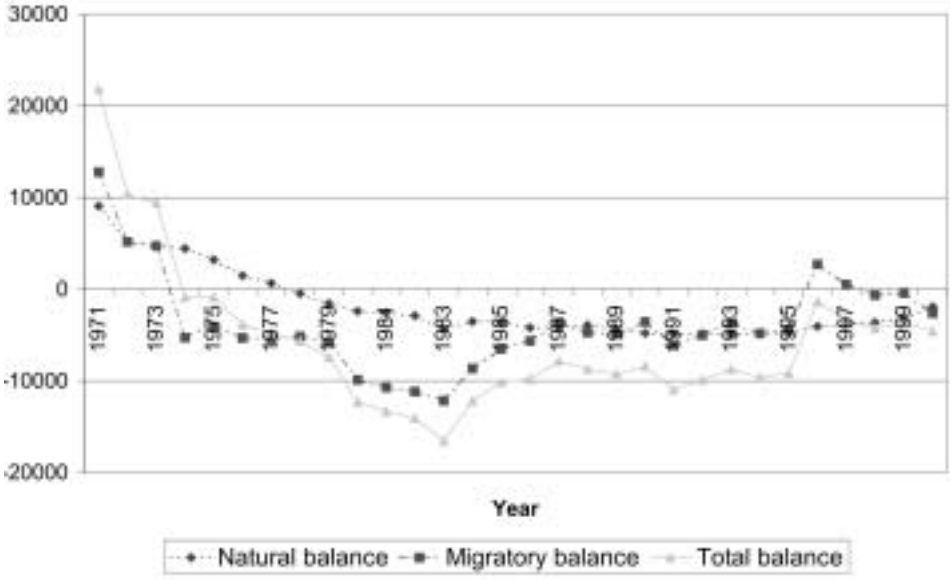
Figure 6. Amount of in-migrants and out-migrants and births and deaths by year



Moreover, looking at the light colours which is shrinking and involving older ages over time, seems to emphasise an ageing effect, which means that people who in-migrated during recent years are older than previous in-migrants.

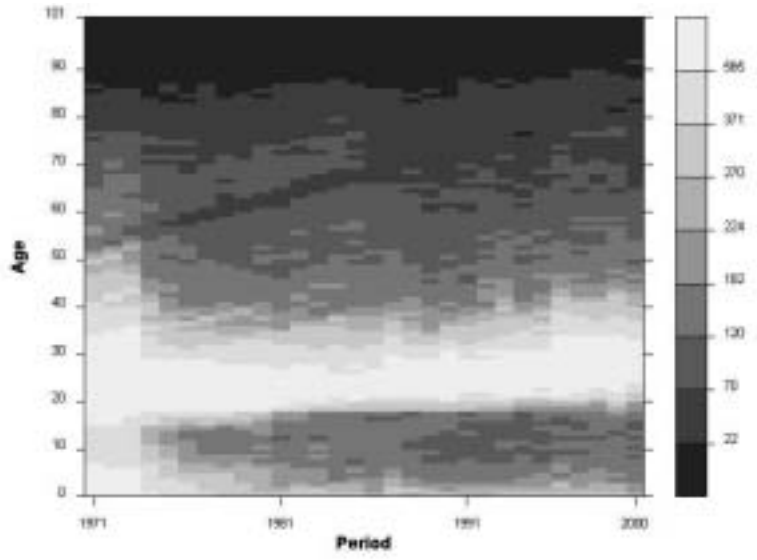
Also the composition of the flow of in-migrants (see Figure 10) changed strongly over time, and while in the 1950s and 1960s in-migrants mostly originated from the South of Italy, during recent years, the flows were characterized by an increasing component of foreigners (IRES, 1994, 2001; Allasino, 2000). In detail, in-migrants coming from the

Figure 7. Natural balance, migratory balance and total balance by year



Source: own elaborations on TLS data

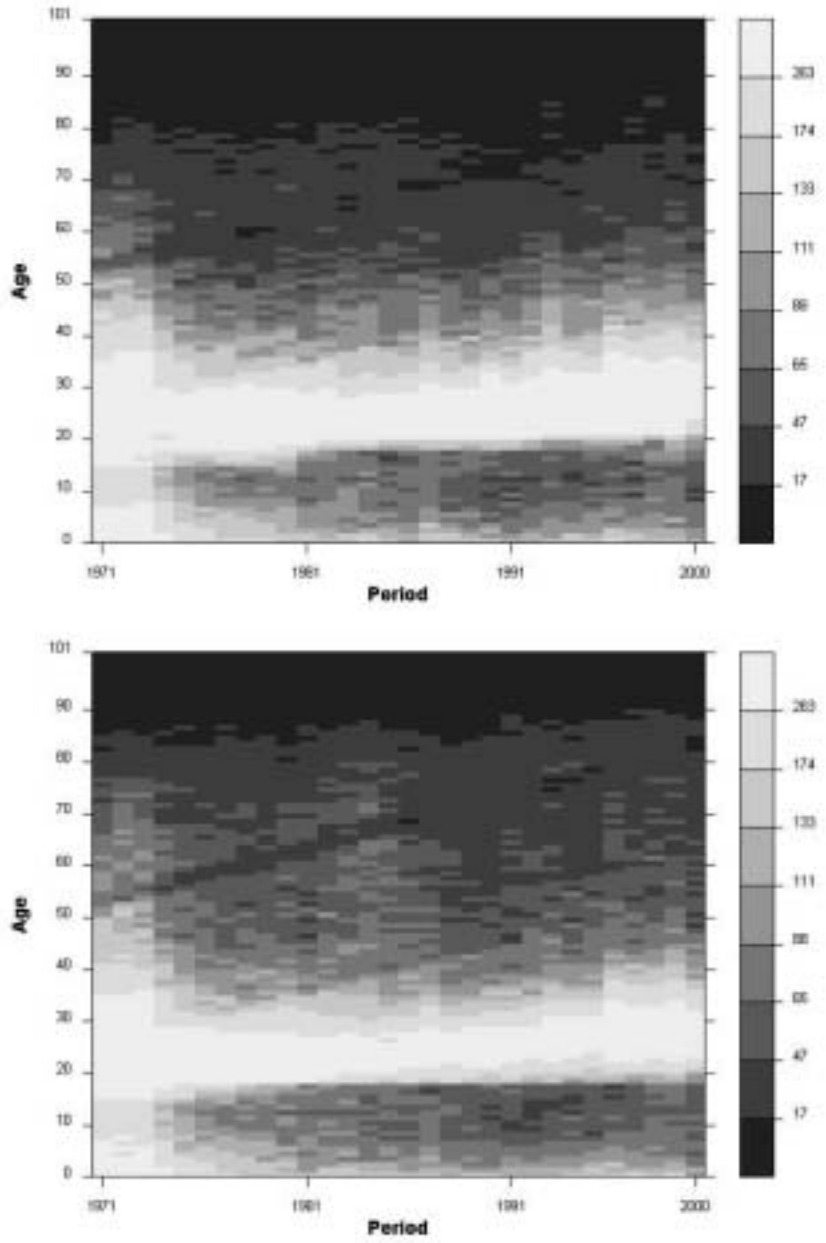
Figure 8. Amount of in-migrants by age and period. Absolute values



Source: own elaborations on TLS data

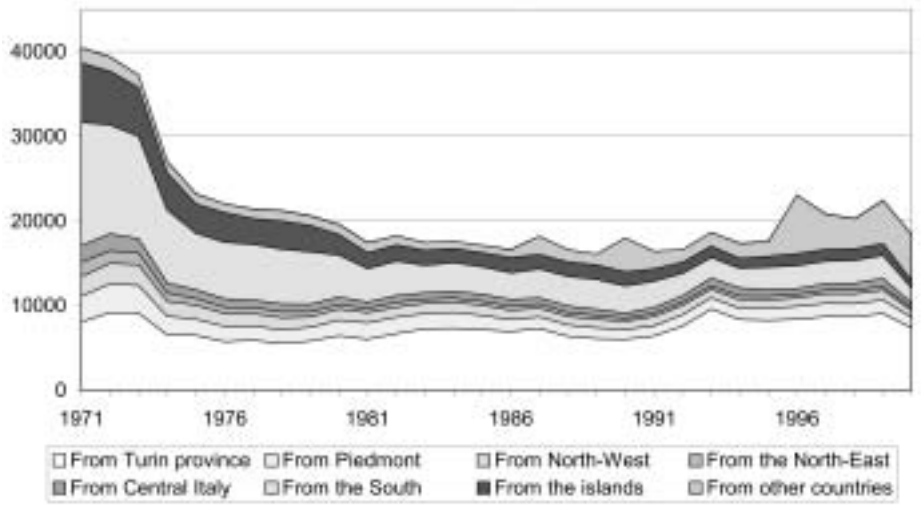
Southern part of Italy amounted to more than a half of the whole in-migrant flow in 1971 and decreased reaching 15% in 2000. On the contrary, foreign immigrants increased their weight, shifting from less than 1% at the beginning of the period under study to the

Figure 9. Amount of in-migrants by age and period. Absolute values. Males (upper graph) and females (lower graph)



29% of recent years. Finally, the proportion of in-migrants from the North and Central Italy (excluding Turin province) decreased just slightly over time, representing 22% of the whole flow in 1971 and 16% in 2000.

Figure 10. In-migrants composition by origin of in-migration*



* The order of the groups in the legend reflects the same order in the graph: in-migrants stemming from Turin province correspond to the lower part of the graph, then the area immediately above represents the group from Piedmont (excluding Turin), and so on.

A further important element determining the amount of Turin population, clearly shown in Figures 6 and 7, consists of out-migrations.

The maps of Figure 11 represent out-migration rates by age and period, emphasising both the main characteristics of the flows and the differences between sexes and time period.

Out-migrations are mainly established by young adults, who may decide to move together with their children, or by elderly people joining the family of origin after their retirement (Rogers and Castro, 1984; Rogers, 1988; Long, 1992).

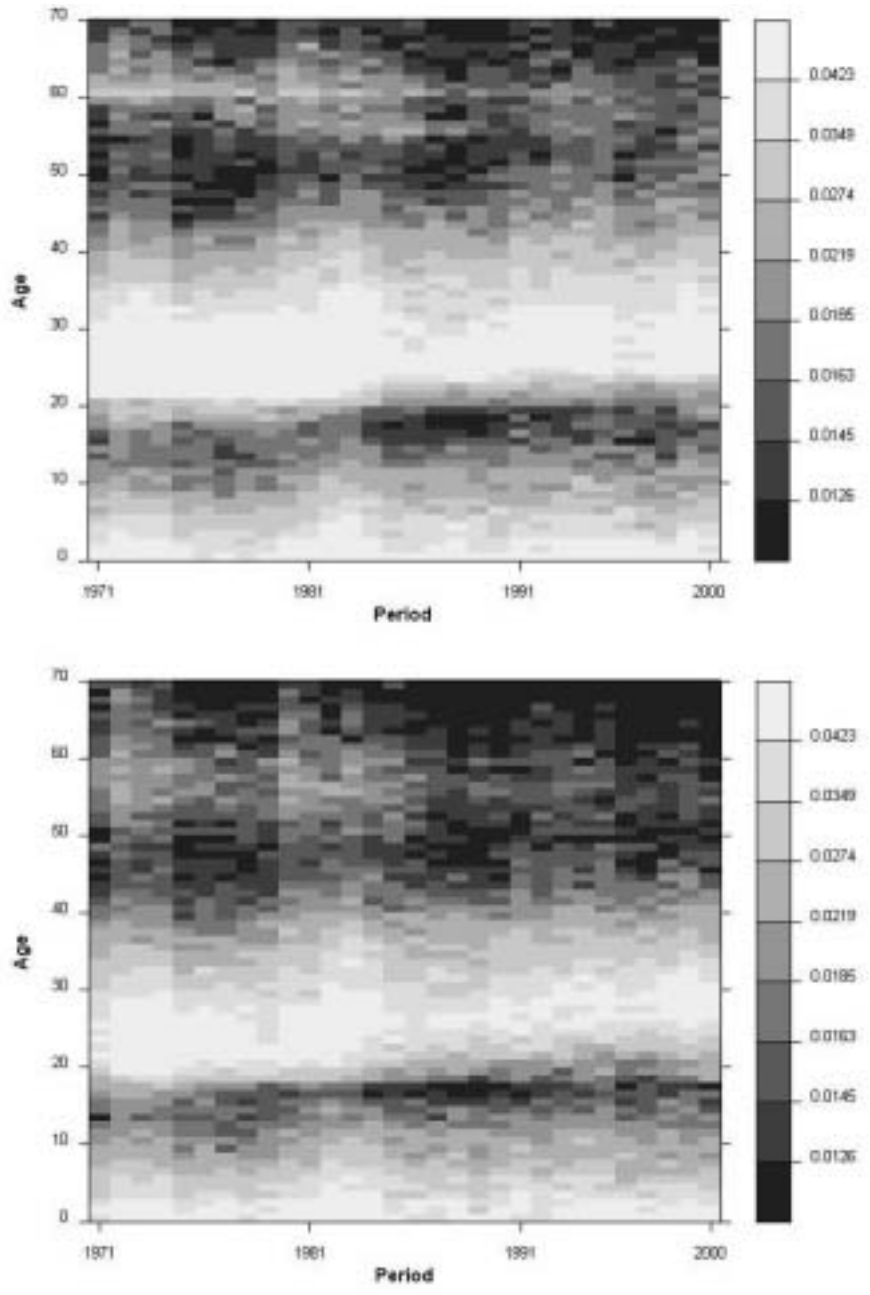
In addition, levels of out-migrations depend on economic crises, which can push people to leave the city to find a better job. This is exactly what happened during the beginning of the 1980s and of the 1990s.

The interesting question at this point is to try to understand the destinations of the move, and to connect them to the evolution of the city.

Plotting the ratio between out-migrations to the province of Turin and to another place, by age and period (see Figure 12 for males and females), the change which took place over the last decades becomes clear. The favourite destination since the beginning of the 1980s was the Turin province, while previous moves mostly occurred towards a different city. Many Italian authors (for instance Bottai, 1990; Occelli and Prizzon, 1995; Tosi, 1997) underlined the increasing importance associated to the quality of the dwelling and to the value of the house as a placement during the 1980s. As a result, the housing market experienced a rise in renovations and in the ratio of owners.

In the urban context not everybody can afford the prices of the housing market, or on

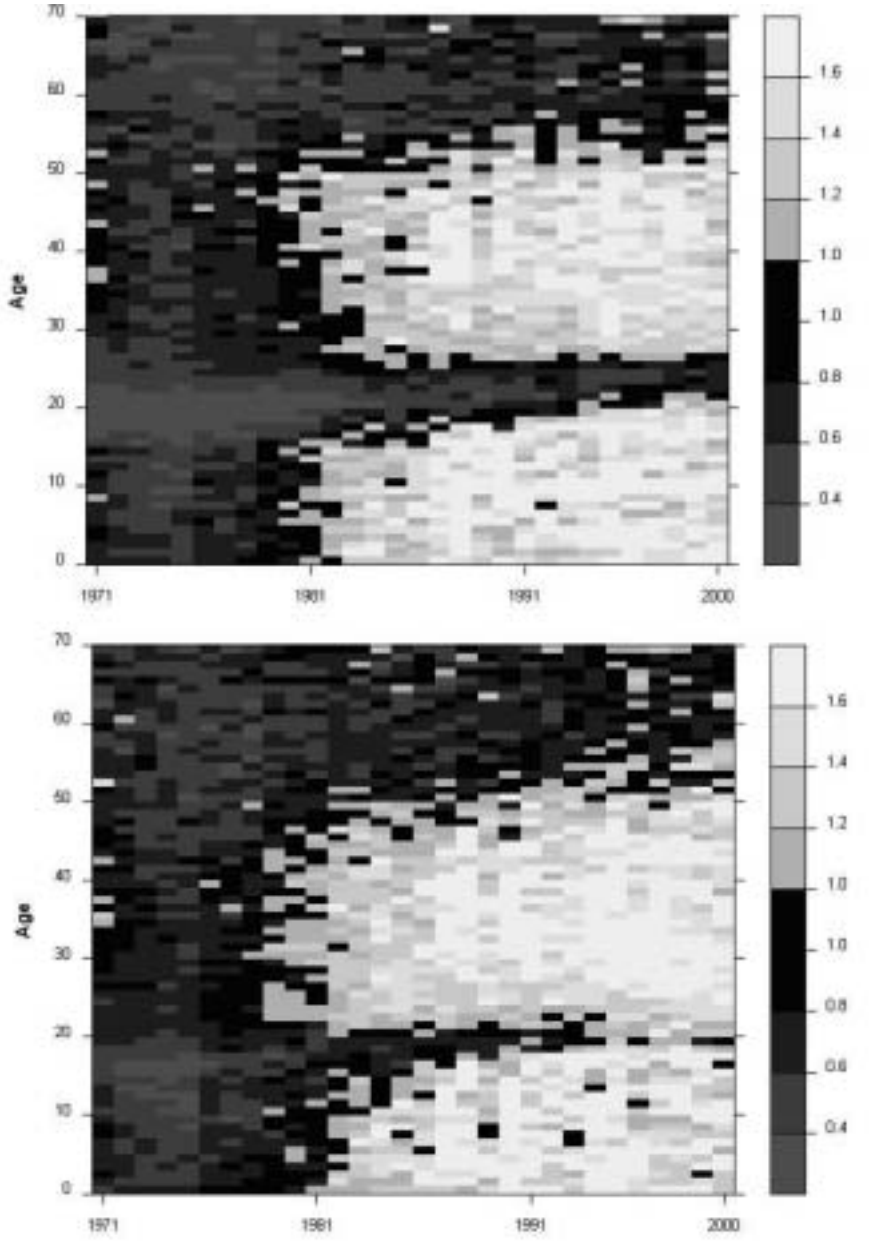
Figure 11. Out-migration rates by age and period. Males and females



the contrary may prefer to live in a better environment, causing sometimes moves to the surrounding areas (Occelli and Prizzon, 1995).

Recent researches confirm these difficult circumstances even in the urban context under

Figure 12. Out-migrations by age and period. Ratio between out-migration to Turin province and out-migrations to another destination. Males and females



Source: own elaborations on TLS data

study. Occelli (1993) for example, comparing the will to move expressed in different areas in Piedmont, found a stronger association with the perception towards the characteristics of the dwelling for Turin residents than for others.

Mela and Davico (1998) report reasons connected with the situation of current housing (too small or of poor quality; too expensive; the impossibility to satisfy in the central municipality the will of becoming owners) as the main grounds for moving out of Turin municipality. Particularly, couples with children, together with families belonging to the working class, are the ones who live the worst situations in the Turin municipality (Occelli and Prizzon, 1995).

Finally, Mela and Davico (1998) assess that a high percentage of residents in the ring areas keep on working, studying or at least going more than once a week Turin municipality.

If we now consider all previous information and simultaneously take into account both the municipality and the ring area, we can summarise the evolution of the Turin municipality and its entire province in three distinct phases, also experienced by other Italian and European cities (Vitali, 1985; Petsimeris, 1995; Conforti and Mela, 1995). During the first phase, which in the case of Turin started at the same time as its industrialization and lasted until the mid 1960s, both the city and its surroundings gained population, with high and positive migration flows, stronger for the inner municipality than other counties. Later on, in the second phase, the growth levels for the city began slowing down, remaining still positive and strong only for the surroundings (1965-1974). The urban area expanded therefore outside the city (Martinotti, 1993), and people began choosing to live in the suburbs instead of the crowded, relatively expensive and polluted centre. In other words, the spatial definition of the urban area had changed, also favoured by the improvement in transportation for passengers and goods, which in turn allowed decentralization (Yapa *et al.*, 1971). Indeed, extended opportunities of commuting decrease the need of coincidence between the place of work and the place of residence, leading to possible spatial separation of these two life-domains.

The last phase of so called de-urbanization, is characterized by negative net migration flows of the Turin municipality and low but still positive flows for the surroundings.

As a result, at the beginning of 2001, the population of Turin city approximately amounted to 900,000 inhabitants, which corresponds to more than a half of the population of Turin's entire metropolitan area (consisting of about 1.6 million), and to two fifths of the province (2.2 million).

This complex history plays an important role also on other demographic components, for example trends in fertility and in nuptiality. The next section focuses on these elements, trying to disentangle the effects of the coexistence of different behavioural models, of changes during the time span and of period effects.

2. Demographic Trends

In Figure 6 the decrease in number of births during the 1970s seems to be very strong. During the decade the number of births halved, shifting from 17 thousand in 1971 to 9 thousand in 1980. Subsequently, it remained almost stable, and nowadays (in 2000) it amounts to more than 7 thousand. At the same time, the total amount of the population

decreased as well, due to suburbanization and deurbanization processes. These processes strongly affected the population in adult ages, which decreased as well over time. Table 3 presents the female resident population aged 15-45 by year, emphasising the decline during time: in 30 years the female population of this age group decreased by 38%, *i.e.* by more than 100 thousand units. Therefore it is not easy to understand what the reduction in births means in terms of fertility reduction, unless we consider the ratio between occurrences and time of exposure, as in the Lexis maps representing fertility rates by age and period.

Table 4 and Figure 13 underline: first, that the rates deeply shrank during time, confirming the general idea we had considering only births, and, second, that we can again notice an ageing effect. The latter is clear also considering that the proportion of fertility realised after the age of 30 increased in 30 years, amounting to 29% in the beginning of the 1970s and 56% in the late 1990s. However, this increase in late ages does not compensate the large reduction of the fertility rates in early ages. Summing for each year the age-specific fertility rates, we obtain the TFR, representing a synthetic measure of fertility during time. The TFR deeply decreased between the mid 1970s and the beginning of the 1980s, shifting from 2.2 children by year to 1.4. The lowest levels were reached during the 1990s, with fertility levels around 1. At the same time, the mean age at birth increased by 3 years and a half, emphasising a strong delay in fertility.

Fertility indeed, as well as many other demographic events, is associated with taking on adult roles, and a fast delay in the transition to adulthood may have strong effects also on reproductive behaviour. An endless delay in marriage and in the decision to start reproduction may imply to give up fertility plans, as De Sandre *et al.* (1997) presented in

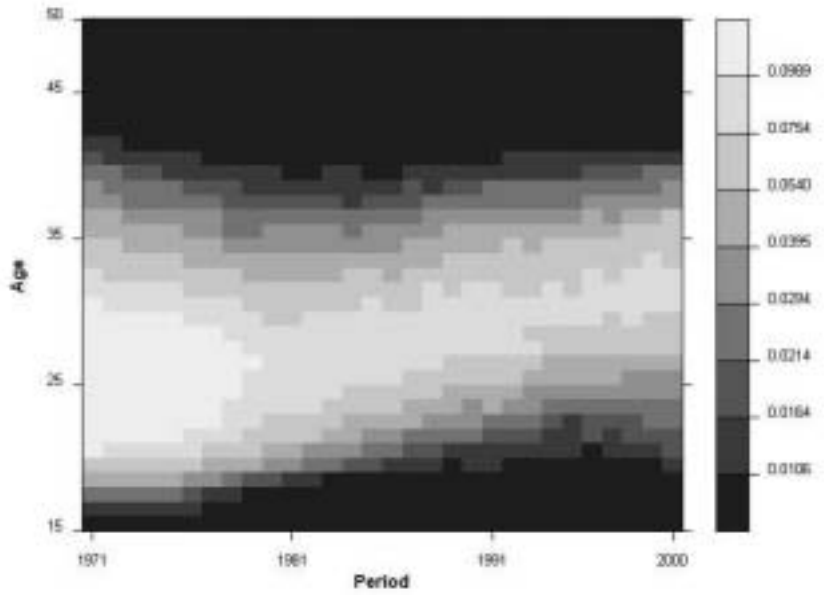
Table 3. Female resident population aged 15-45 by year (in thousands)

1971	1976	1981	1986	1991	1996	2000
356.2	353.9	325.1	285.2	255.2	228.9	219.1

Table 4. Age specific fertility rates by period (by thousands), TFR (by thousands) and mean age at birth. Resident women

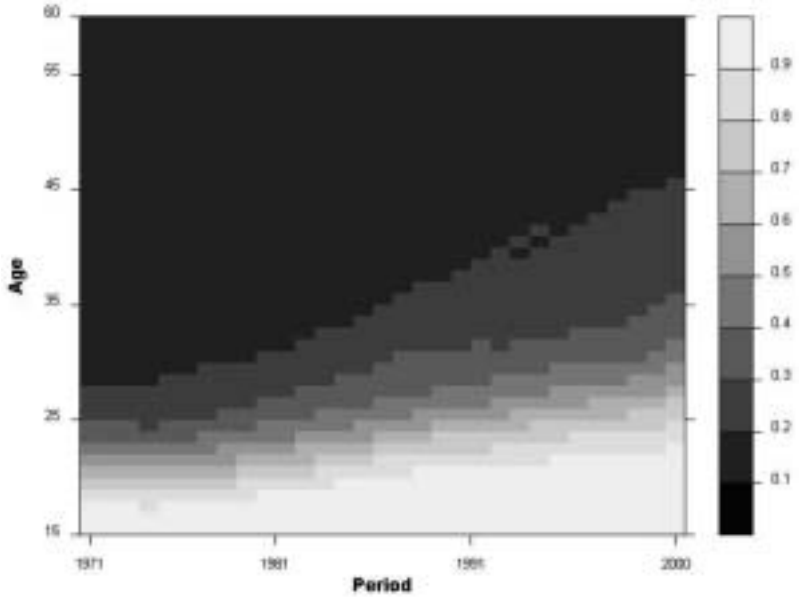
	1971--1975	1976--1980	1981--1985	1986--1990	1991--1995	1996--2000
15-19	34	24	10	5	4	3
20-24	138	103	65	39	27	22
25-29	142	112	88	80	70	61
30-34	84	65	55	60	69	76
35-39	36	26	20	23	28	36
40-44	9	6	3	3	5	6
TFR	2,213	1,680	1,203	1,056	1,010	1,017
Mean age	26.7	26.7	27.4	28.6	29.6	30.4

Figure 13. Fertility rates of resident women in Turin municipality



Source: own elaborations on TLS data

Figure 14. Percentage of unmarried women by age and period



Source: own elaborations on TLS data

their book. In last decades various countries experienced delays in transition to adulthood (concerning this phenomenon in Europe see Cavalli and Galland, 1995), Italy and Spain being the leader countries (Billari *et al.*, 2002).

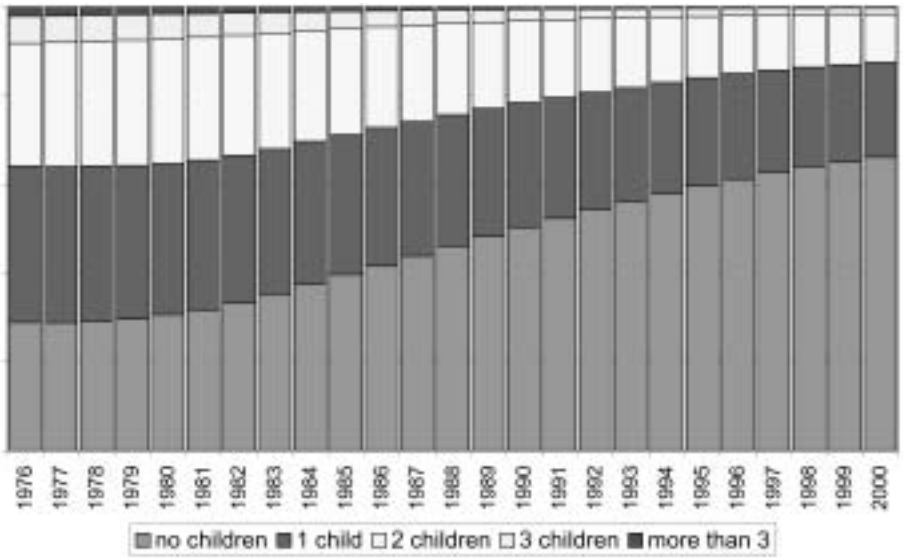
Also in the urban context of the Turin municipality, delays in marriage and fertility plans are clear. Figure 14 represents for example the percentage of unmarried women by age and period, emphasising that marriage happens at older ages. As an example, while at the beginning of the 1970s, half of the women married before the age of 22, in 2000 this age was 30.

A delay in experiencing adult roles (for instance marrying) also affects the composition of the families, and this is clear when we focus on specific age groups of women and compare the number of children they already had. As an example, in figure 15 we only considered 25-35 year-old women by number of children. During time the percentage of women in this age group with no children increased strongly, shifting from 30% in 1979 to more than 60% in 2000.

Delay in fertility behaviour is also clear examining Figure 16, which represent the ratio of women who already had at least one child, two children and so on by age and period. While almost every woman at the end of the reproductive period has become mother, progression to higher parities is seriously challenged. As a result, only one out of two women with one child has the second one, and whenever this happens, it occurs at older ages than in the past. Obviously, less and less women proceed to higher parities.

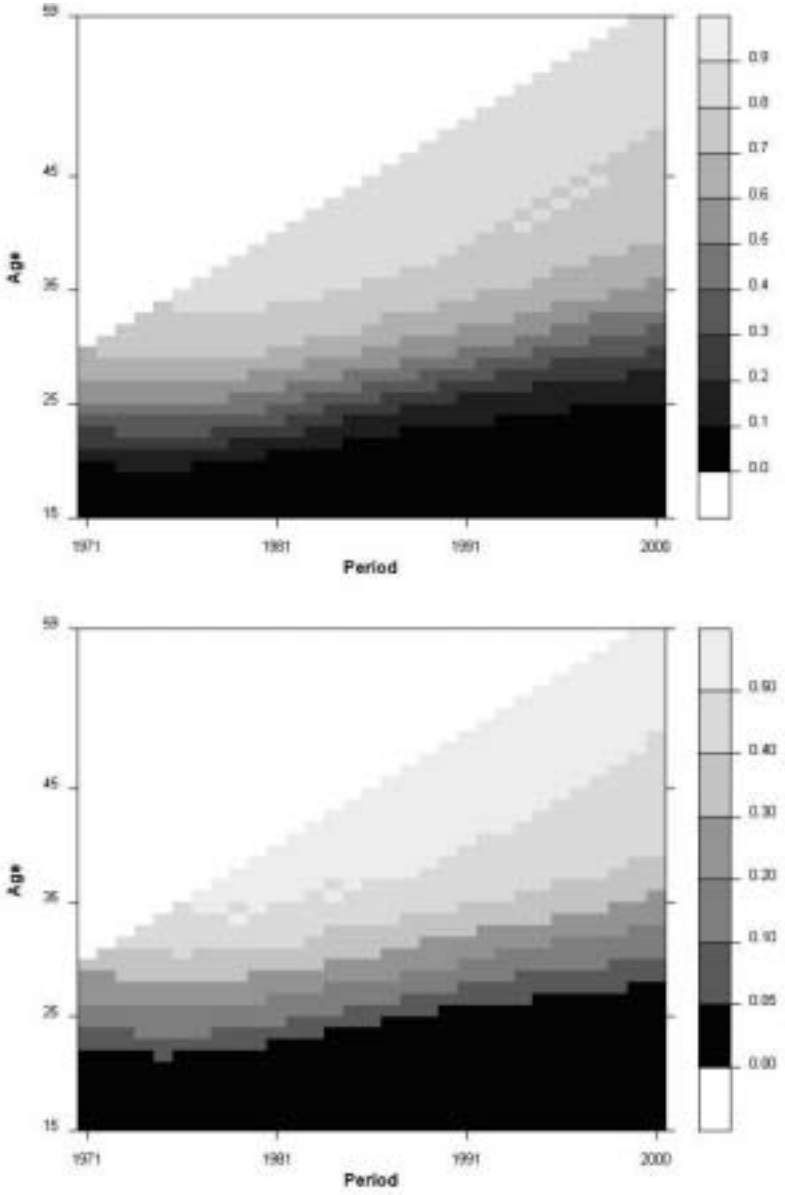
These trends reflect an ideal of at least one child, and almost all the families seem not to be willing to give up: it does not matter how late they become parent, the important

Figure 15. 25-35 years-old women by number of children already had



Source: own elaborations on TLS data

Figure 16. Ratio of women who already had at least one child (first graph) or two children (second) by age and period

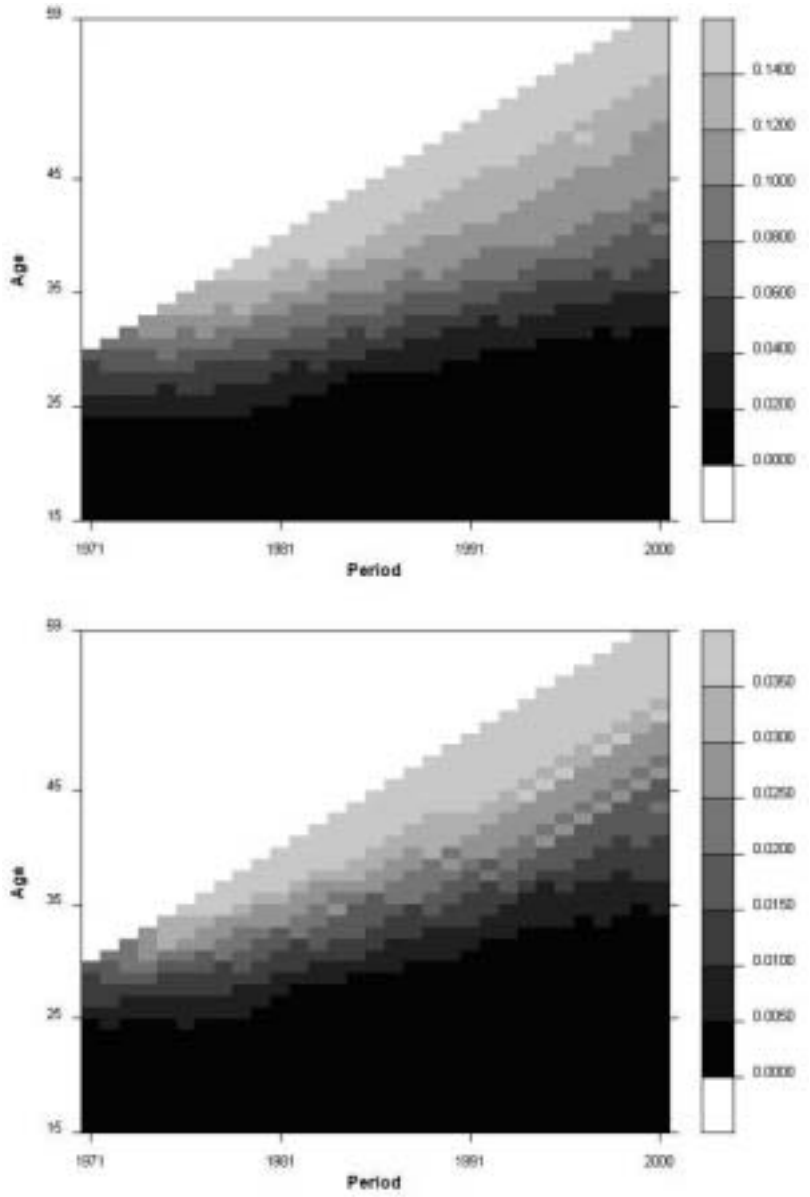


Source: own elaborations on TLS data

thing is to have at least one child. The latter phenomenon conforms to a Northern Italian custom, contrasting with the one in the Southern part of Italy, where people seem to choose between no children at all and more than one child (Santini, 1997).

Exactly the latter remark suggests to break down the population into natives and in-

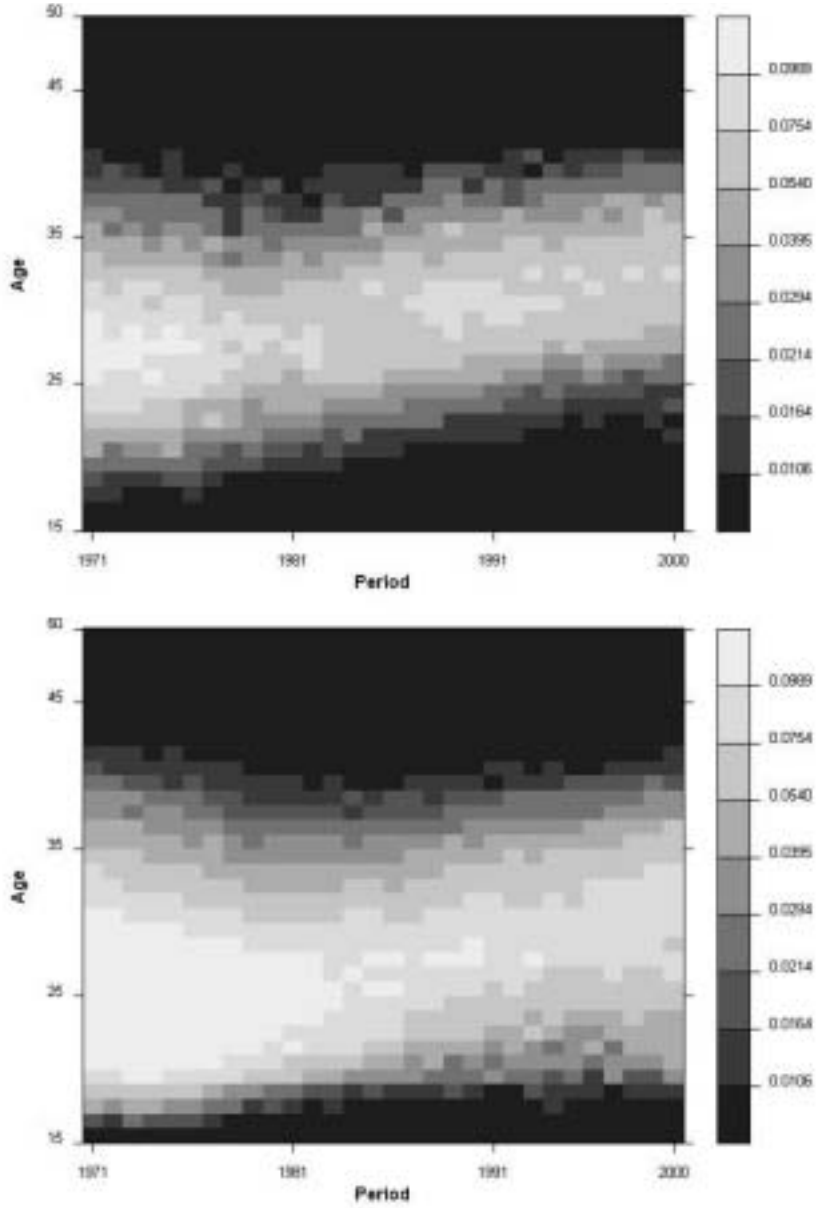
Figure 17. Ratio of women who already had at least three (first graph) or four children (second) by age and period



Source: own elaborations on TLS data

migrants, and the comparison between the two graphs of Figure 18 as well as between Table 5 and 6 show some communality and even some strong difference. As common factors, both subgroups experience a strong delay and a reduction of fertility, with behaviour of in-migrants converging to those of the natives, at least until the beginning of the 1990s.

Figure 18. Fertility rates of resident women in Turin municipality. Autochthon and in-migrants



Source: own elaborations on TLS data

However, both the levels and the timing of fertility are very different to each over, in-migrants fertility strongly exceeding that of autochthones: at the beginning of the period under study, where the difference reaches its maximum, in-migrants have in mean 2.5 children, while autochthones 1.6. At the same time, age at birth increased by more than

2 years in 3 decades for both the subgroups, but in-migrants fertility precedes that of natives by about 24 months.

These huge differences suggest therefore that we are currently dealing with at least two subgroups, in-migrants showing a higher and even earlier fertility (Corsini, 1967).

Unfortunately, this analysis can not be considered straightforward. Indeed, beyond the fact that these subgroups may refer to different fertility plans, we have to consider that we are only focusing on residencies in Turin. Therefore, since marriage could be a trigger for in-migration, it is likely we are selecting for in-migrants just particular life cycle stages, to which a higher probability of having children is associated.

Thus, fertility of in-migrants may appear, wrongly, higher than that of natives just for the latter reason: we have to check also for the exposure period, and the better solution seems to consider the whole reproductive stage for both natives and in-migrants. In other words, if a woman in-migrated in Turin at the age of 25, we will consider all her reproductive life, starting from the age of 15, and if she had already had some children before the in-migration, they will be taken into account to calculate the corresponding rates.

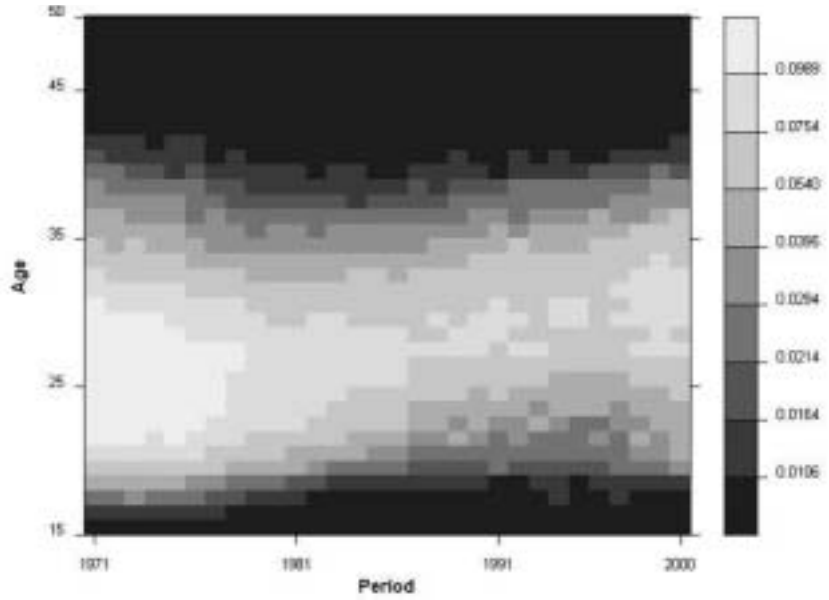
Table 5. Age specific fertility rates by period (by thousands), TFR (by thousands) and mean age at birth. Resident women, autochthones

	1971--1975	1976--1980	1981--1985	1986--1990	1991--1995	1996--2000
15-19	11	9	4	3	2	2
20-24	68	48	31	22	16	11
25-29	116	88	70	66	57	48
30-34	74	56	54	63	71	73
35-39	28	20	17	27	30	37
40-44	5	3	2	3	5	6
TFR	1,505	1,119	890	918	909	888
Mean age	27.9	27.9	28.5	29.7	30.5	31.3

Table 6. Age specific fertility rates by period (by thousands), TFR (by thousands) and mean age at birth. Resident women, in-migrants

	1971--1975	1976--1980	1981--1985	1986--1990	1991--1995	1996--2000
15-19	46	35	18	10	10	9
20-24	159	126	87	58	46	46
25-29	148	118	94	89	81	78
30-34	86	67	55	58	67	78
35-39	38	27	21	22	27	35
40-44	9	6	4	4	5	6
TFR	2,433	1,894	1,389	1,209	1,181	1,257
Mean age	26.4	26.3	26.7	27.7	28.5	29.0

Figure 19. Fertility rates of in-migrants, considering the entire reproductive stage



As a result, we are again somehow selecting the people we are considering, and selection is stronger in recent times than in the previous period.

The new picture (Figure 19) confirms that fertility rates of in-migrants are higher than those of natives, but the rates based on the whole reproductive stage are lower than those we would find focusing only on the residence period. Even the mean age at birth is now lower than the one we obtained considering only the residence period (Table 7). Also the comparison of TFRs leads to the same conclusions (Figure 20).

Again, the idea of a reduction and delay of fertility is confirmed, as well as the

Table 7. Age specific fertility rates by period (by thousands), TFR (by thousands) and mean age at birth. In-migrants, considering the whole reproductive period

	1971--1975	**1976--1980**	**1981--1985**	**1986--1990**	**1991--1995**	**1996--2000**
15-19	34	27	15	9	9	10
20-24	125	100	71	48	38	39
25-29	135	108	86	78	70	69
30-34	83	64	54	56	64	74
35-39	38	27	21	22	27	35
40-44	10	6	4	4	5	6
TFR	2,131	1,658	1,255	1,089	1,061	1,162
Mean age	26.9	26.7	27.1	28.0	28.8	29.2

Figure 20. Total fertility rates by subgroup

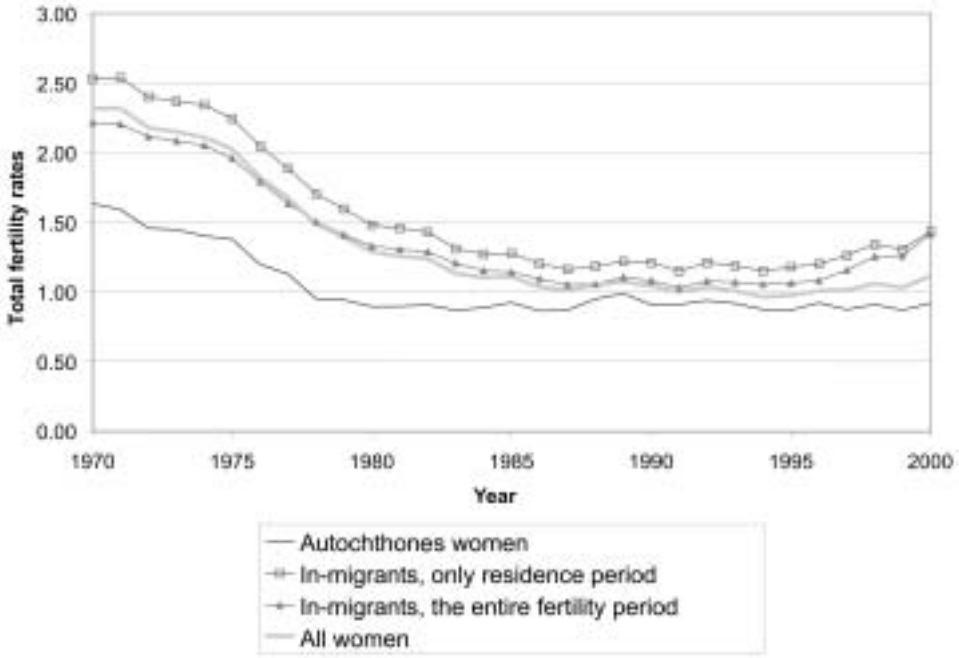
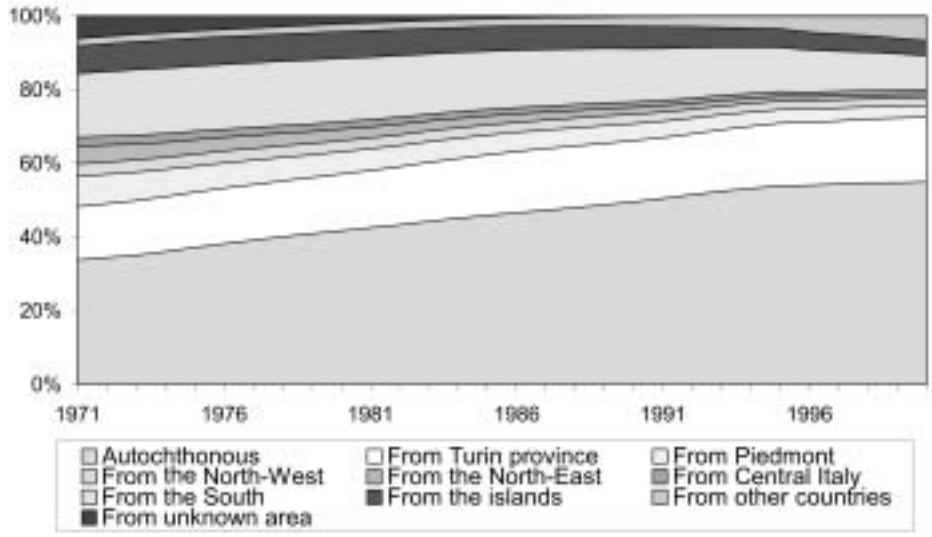


Figure 21. Relative composition of female population in reproductive ages*



* Notice that the order of the groups in the legend reflects the same order in the graph: for instance, the authoctonouses correspond to the part below of the graph, then the area immediately above represents the group from the province of Turin, and so on.

assimilation of the behaviour of in-migrants to natives. Similar convergences took place elsewhere in the world, and what occurred between Italian immigrants in US seems to be very interesting. Livi Bacci (1961) pointed out that Italians began to assimilate when the immigrant flow ceased to be a mass phenomenon, and moreover that the economic crisis quickened the transition, affecting immigrants (weaker and belonging – at least most of them – to the working class) much more than natives. Both reasons may apply to the Turin municipality, but it could be that a change in the composition of in-migrant flows emphasizes fertility reduction.

The next step consists thus in taking into account the origin of in-migration as well as analysing the female population in the reproductive period by origin and checking the existence of a variety of fertility models. With this aim, we decomposed Italy in different zones, representing distinct origins of in-migration (Turin province, North-East Italy, North-West, Centre, South, and the islands).

We already underlined that female population in reproductive ages decreased strongly during time, and Figure 21 and Table 8 emphasise a substantial change in its composition. In this respect, it is clear how the relative importance of the in-migrant population is decreasing over time and at the same time foreigners are constituting an higher proportion over time: in the last decade foreign immigrants doubled their relative importance (in 1991

Table 8. Absolute and relative composition of female population in reproductive ages. Selected periods

(Absolute values)	**1971**	**1981**	**1991**	**2000**
Autochthon	120,282	138,242	128,829	120,455
Turin province	51,468	50,577	42,202	38,542
Piedmont	29,477	19,137	11,296	6,944
North-West	11,941	9,709	6,238	4,551
North-East	17,163	9,671	4,527	2,165
Central Italy	8,764	6,224	3,619	2,574
South and Islands	87,951	78,540	50,976	29,048
Foreigners	7,242	7,058	7,101	14,687
Unknown	21,895	5,941	381	114
Total	356,183	325,099	255,169	219,080
(Relative values)	**1971**	**1981**	**1991**	**2000**
Autochthon	34	43	50	55
Turin province	14	16	17	18
Piedmont	8	6	4	3
North-West	3	3	2	2
North-East	5	3	2	1
Central Italy	2	2	1	1
South and Islands	25	24	20	13
Foreigners	2	2	3	7
Unknown	6	2	0	0
Total	100	100	100	100

they constituted 2% of all females in the reproductive age, in 2000 7%). Conversely, people coming from the Mediterranean part of Italy, both from the South and the Islands, which at the beginning of the period under study represented 1 woman out of 4 in the reproductive age, are lowering their weight, representing nowadays just 13%.

In sum, in 2000 38 women in the reproductive age out of 100 are internal in-migrants, 55 are autochthones and 7 are from a foreign country. The same proportions calculated in 1971 were strongly different (more than half the women in the reproductive age stem from a different area of Italy).

If these trends continue in the future, we may expect an increasing proportion of immigrants (*i.e.* foreign in-migrants), and concerning internal in-migration it is plausible that the greatest part of moves will occur from the areas close to the Turin municipality (Turin province or North Italy in general).

Having this in mind, we may analyse both residential fertility and fertility realised during the whole reproductive period by origin of in-migration. Figure 22 and Figure 23 represent the TFR distinguishing by origin of in-migration and considering, first, only the residence period in the Turin municipality, and second, the whole reproductive period.

Both graphs emphasise the existence of specific fertility models. As an example, in-migrants stemming from the Southern part of Italy show as expected the highest fertility rates, both when we only focus on the residence period and on the entire reproductive stage. The TFR declines over time, shifting from 3 at the beginning of the 1970s to about 1.4 in the recent period. No signs of a clear increase in fertility in last years are evident.

Figure 22. TFR of in-migrant population by origin of in-migration considering the only residence period

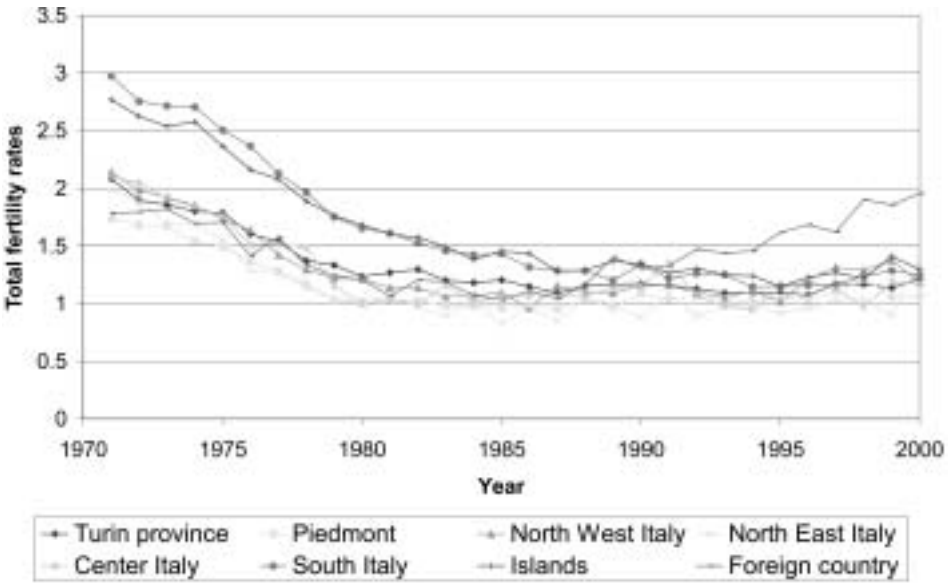
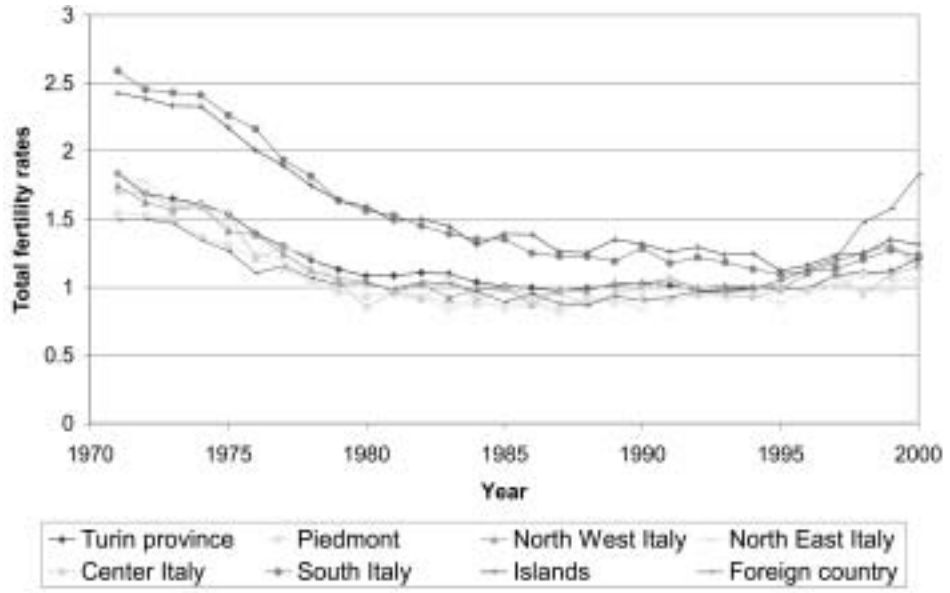


Figure 23. TFR of in-migrant population by origin of in-migration considering the whole reproductive period



As a result, the difference between fertility behaviour of this group of in-migrants and the autochthon population is particularly strong at the beginning of the period under study and tends to vanish over time without disappearing.

A different fertility model can then be associated to the remaining part of Italy, with lower fertility rates than the South, declining over time, and probably only slightly increasing in the recent past.

Interesting is also the case of immigrants (*i.e.* foreign in-migrants), for whom fertility rates, after a reduction occurred during the 1970s until the mid 1980s, increased steadily over time, leading to a TFR (when only considering residence period) of around 2 in 2000. Therefore, while for all other origins of in-migration assimilation to the host area is evident, for this specific group fertility levels become more and more different over time.

3. Discussion

Considering the particular context of the Turin municipality means dealing with its specificity. The Turin municipality is indeed an important urban centre, which during time represented a pole of attraction for an incessant flow of in-migrants. Migratory components have been in the past (and are still nowadays) the major factors of replacement of the population, exceeding natural components, and this has many consequences in other demographic phenomena.

Concerning in-migrations, their origin constitutes a source of heterogeneity, since people stemming from different areas refer to various fertility models. Data shows convergence across in-migrant and autochthon behaviour, except for recent years.

Over time besides many changes occurred, and fertility behaviour of resident people at present is extremely different from the past (concerning both intensity of the phenomenon and its time scheduling). This trend regards all the subpopulation taken into account, and delays in reproduction (as well as in marriages) and even a reduction in fertility levels are generalized phenomena. Only foreign immigrants seem to follow a different behaviour, and during the last decade instead of decreasing as for other origins of in-migration, the TFR increased over time. For all other origins, a strong reduction in fertility levels is confirmed.

Focusing on out-migration, we showed how the favourite destination of out-migrants changed during time: while in the past who moved preferred another city, nowadays he/she chooses to live in Turin province. This emerging behaviour may be linked to the problem of finding a suitable (or cheap) house in the core of the urban area, or to the fact that being an owner is the ideal situation for many families and it is more difficult in the Turin municipality than elsewhere. Therefore, out-migration may be related to fertility behaviour.

These issues have been only sketched in the general analysis here presented, and certainly need deeper exploration. With this aim we present two applied chapters (*i.e.*: Chapter 4 – Fertility and time changes – and Chapter 5 – Fertility and out-migration), discussing in the Appendix the kind of statistical models we will employ.

4. The Changing Relationship between Female Labour Force Participation and Fertility

In Chapter 3, we underlined the deep changes that have occurred in fertility rates during the 1970s and the 1980s in the Turin municipality. Simultaneously with changes in fertility, the social and economic characteristics of the population have been subjected to important changes, such as for instance, a strong increase in educational attainment and an increase in female labour force participation, with a feminilisation of the labour force (IRES, 2001). These shifts have been experienced since the 1960s in many countries of the industrialized world, and have often taken place at the same time as demographic changes. Scholars from different theoretical approaches have developed explanations on the connection between social and economic change and the demographic behaviour considered. Both economic and cultural factors have been deemed responsible for this link.

Within the demographic literature, for instance, the most widely used explanation deals with the concept of 'second demographic transition', developed by Lesthaeghe and van de Kaa and employed for the first time in English by Lesthaeghe and van de Kaa (1986). The second demographic transition focuses on the idea of 'ideational shift'. The competing economic explanations besides, emphasise either the role of an increased female economic autonomy (Becker, 1981c) or the importance of relative economic deprivation (Easterlin and Crimmins, 1985) for fertility behaviour.

In this Chapter, we develop a connection between changes in fertility behaviour and changes in other factors over time. The basic questions are the following. Has the link between fertility and other aspects of life changed? If it has, are these changes only due to a change in the composition of the women?

To put particular emphasis on these aspects, we focus on the transition from the first to the second child, since, as we have already mentioned, in the context we are studying the transition to first child is experienced by a vast majority of women, while progression to higher parities has become the crucial issue of fertility decline.

1. The Theoretical Framework: How Social Changes Affect Demographic Phenomena

As we have discussed above, recent demographic changes have taken place together with some social and economic changes, and this has been the case in a variety of industrialized countries (with remarkable differences with respect to the incidence and timing of these phenomena). These trends lead to a rapid growth of theories, based on

various approaches. We should not consider explanatory theories as competing against each other, but as emphasising the different aspects leading to demographic change.

The first set of theories we underline connects changes in family building to ideational changes in value orientations. In this view, the emergence of individualization, post-materialist values, symmetric gender roles and female emancipation lead to changes in family structures (see for example Lesthaeghe and Meekers, 1986). This results in delaying parenthood, lowering overall fertility, and increasing the percentage of unmarried cohabitations over marriages.

Indeed, the traditional set of gender roles has been in favour of men (Mason, 1993; Pinnelli and Di Giulio, 1999). With the improved conditions and the new roles of women, also gender roles have been debated. As a result, attitudes toward family formation have changed, so that bringing up large numbers of children is less attractive for women and men (Bimbi and La Mendola, 1999): if women do not maintain their traditional role of housewives, even childrearing has to be re-negotiated within the couple.

In fact, the impact of ideational change also depends on institutional and other cultural factors, which both contribute to generate diverse social and demographic outcomes (Billari and Wilson, 2001). As an example Reher (1998) emphasises the role of family ties on demographic behaviours and uses differences in family systems to explain the heterogeneity in the characteristics of European societies. Indeed, there are areas where family ties are relatively strong (for instance Southern Europe) and others where they are relatively weak (most of the Centre and North of Europe and the United States) characterising differently the society: for instance to strong family ties we may associate a greater social cohesion, and therefore a low incidence of divorce and extramarital births, and in general a high level of social conservativism, hampering at the same time social changes.

Even the welfare state may strongly affect life courses. As Mayer (1997) underlines, the State defines the entry and the exit to education and work, regulates marital status changes, influences the housing market. Differences in welfare state regimes imply differences in the way people experience specific events. In Italy for example, the rigidities of the housing and labour market and the substantial absence of economic incentives for singles do not encourage young adults to establish an independent household, and this has an impact on other linked behaviours (such as fertility).

Therefore, although many countries of the industrialised world experienced the same socioeconomic changes, convergence in demographic behaviour can not be reached if the underlying institutional structures (Mayer, 1997) or family systems (Reher, 1998) remain different.

A distinct interpretation of general changes in fertility and family formation emphasises the impact of economic factors on fertility decisions, both on a macro and micro level.

Easterlin and Crimmins (1985) for example underlined the role of relative economic status as a macro characteristic that impacts on behaviour toward childbearing. Whenever the earning potential of young men is insufficient to satisfy their material aspirations (which have been formed in parental households), couples limit their fertility

in order to devote their limited available resources to the consumption of other goods. The size of the cohort is therefore an important element of this mechanism, and through the idea of relative economic status we may explain the differing fertility of baby boom and baby bust generations, due to the impact of their size. Unfortunately, this schema fails to justify the emergence of counter-cyclical fertility (Butz and Ward, 1979).

A different approach applies micro-economic analysis to fertility behaviour. In new home economics, the main hypothesis is that individuals act rationally, by maximising their utility function. A change in social structure may have important consequences on fertility decisions, acting directly or indirectly. Let us present some examples.

1. Which Utility Function?

In a traditional society, marriage may be considered as a partnership for the purpose of joint production and joint consumption, and has, as a main role, the production and rearing of children, which constitute labour force for the future. Therefore, fertility decisions (among others) are taken within the family maximising the common household utility function of the two members.

Whenever household utility is maximized, the first consequence is the division of labour and specialization of tasks between husband and wife (Weiss, 1997). Indeed, household utility maximisation yields that it is more convenient that one of the two members of the couple stays at home, while the other specialises in the labour market. This allows the couple to dispose of consumption goods and at the same time to provide necessary transformations to make them consumable. For instance, a wife can specialise in household capital and a husband in building a career.

The specialisation decision is optimum one when the utility to maximise is the household utility as a whole. However, since family decisions always contain the possibility of conflict, we must take into account that family decisions are also based on individual interest, and therefore they are the result of internal negotiation (Ott, 1995; Berhman, 1997). This bargaining process gains importance according to the change in values we discussed above: individualisation, symmetric gender roles and female emancipation lead to redefine internal roles and to shift from the maximisation of the household utility function to the negotiation between members acting on the base of distinct utility functions. In this framework, the bargaining power of each partner becomes crucial and the previous solution (specialisation) may no longer be the best one. Each individual has to try to improve his/her position within the couple depending on his/her alternatives outside the family: who is in the best position outside the family gains more power in the negotiation process and has a better insurance against the split of the couple. We may just think of the difference between an economically independent woman and a dependent one: while the first in case of split would be able to afford the cost of living, the second one would on the contrary try to avoid the splitting, therefore losing her bargaining power.

Even concerning fertility the bargain process could be very important: since none of the bargainers would agree to an outcome that is lower than his/her payoff, disagreement

may result in continuing the current situation without any change. Indeed, while in general having children would increase household utility, as a secondary effect it would decrease the female utility, because her situation outside the family becomes worst (the chances of proceeding in the career are lower, maybe there is the need of quitting the job for a short period hear birth, ...) causing a drop in female bargaining power. As a result in certain cases the best solution is not to have children.

2. Educational Attainment and Female Role in Paid Work

Several empirical papers find a positive effect on fertility of male incomes and negative effects of female wages (see for example Heckman and Walker, 1990; Devaney, 1983).

To understand these relations, we should remember that even the decision to have a child requires an evaluation of its opportunity and costs. The latter may be stronger for the women, since most of them have to leave paid work for some period of time around birth (Brewster and Rindfuss, 2000): having children is female time intensive. For this reason, female wages are seen to have both an income and substitution effect on fertility; besides male wages only exert an income effect. In detail, the *substitution effect* implies that when income increases, even the demand for goods increases, as well as the demand for children; the *income effect* refers more directly to the opportunity costs, predicting that if female wages increase, it is more expensive to rear children (because mothers need to quit job at least for a short time period), thus damping fertility.

Then, we have to take into account that there exists a positive relationship between wages and human capital, since higher human capital accumulation is in general associated to higher incomes, and quitting job may be more costly for women with higher wages.

In the human capital model (Becker, 1993), forgone earnings due to childbirth (for the mothers) are a key concept. They can be disaggregated in *forgone earnings while caring for a child*, since the woman has to spend some time out of the labour market, *forgone returns to work experience*, which corresponds to the fact that while taking care of children the working experience does not improve, and even *forgone earnings due to a de-evaluation of human capital*, because a mother upon returning to the labour force will receive a lower wage than she received before quitting the job, and that often, if interruption occurred, proceeding in the career is harder (Gustafsson, 1999).

In particular, Joshi, (2002) found that highly educated women experience the smallest relative loss of earnings at motherhood compared to less educated women, probably due to the fact that they had better chances of choosing a suitable job, enabling conciliation with fertility and may even afford the costs of unsubsidised private child care. This would be compatible with Brewster and Rinfuss (2000) findings assessing that in most countries women who are highly educated or hold jobs that require long training periods are less likely to leave paid work, and whenever this happens they return more quickly. Nevertheless, their delay in motherhood is very strong.

The latter problem of conciliating childcare and economically productive work (known in the literature as *maternal role incompatibility hypothesis*; Stycos and Weller, 1967) rose

with industrialization. Indeed, while in developing countries the organisation of both production and childcare, especially the availability to women of inexpensive and reliable parental surrogates, determined a low level of conflict between working and mothering (Mason and Palan, 1981; Castro Martin, 1995), in developed countries this is no longer true.

Labour, in the industrial organisation of production, is organised to favour the interests of employers more than the interests of households, and women have to work in a factory, office or store where children are not welcome and the time schedule is rarely flexible. Therefore, incompatibility is likely to be there, and since nowadays it has become more and more difficult to have children with a single income, and there is an increasing agreement that two incomes are necessary to obtain a home suitable for childbearing and childrearing (as Murphy, 1992, underlines reviewing some recent empirical findings for Sweden, Poland, USSR), this may constitute a problem.

A way to overcome this issue consists in choosing jobs with more flexible time scheduling (for instance part-time jobs), or enjoy childcare support services, which can help women in their maternal role. Exactly for these reasons, at the macro level the relationship between fertility and female employment rates in developed countries is changing, turning from negative to positive (Ahn and Mira, 1999; Brewster and Rindfuss, 2000; Engelhardt and Prskawetz, 2002): in a high participation regime, working conditions are more favourable to women, allowing a greater choice and higher opportunities to conciliate family and job. As a result, nowadays, in a high participation regime the fertility rate is more likely to be positively associated with the participation rate.

In fact, the presence in the labour market of intensive part-time supply does not necessarily lead to a widespread conciliation between roles. While for instance in Britain changes toward flexibility occurred in the labour market have actually favoured the conciliation between roles (Joshi, 2002). Retherford *et al.* (1996) found that Japanese women (especially highly educated), despite an intensive part-time supply, anyway prefer to leave the job after having married. Both the low profile and low wages of many part-time jobs make part-time unattractive. Furthermore, tax and benefit systems disincentive female full-time work, favouring the traditional role. As a consequence, many women with higher education do not work at all, devoting instead their full energies to domestic duties. In their work, Retherford *et al.* (1996) underline that women work part-time only to earn money to pay expenses related to children's education, and not to fulfil their personal aspirations.

3. Quality and Quantity Trade-off

Another important component we need to consider consists in the trade off between quantity and quality of children (Becker, 1981a).

While in traditional societies, having a high number of children was profitable for rural activities, in modern ones parents may invest in few children of higher quality. Indeed, parent's utility rises also with an increase of quality of children.

Moreover, the value of quality grows when we consider the idea of altruism of parents toward their children (Becker, 1981b), assuming that the utility function of parents depends not only on their own consumption, but also on the utility of their children. This concept is particularly appealing when we deal with a familistic society, as the Italian one, where the success of the sons is viewed as the success of their parents (Casacchia and Dalla Zuanna, 1999). Thus, in such a context, it seems more favourable to have a low number of children of 'high quality' than a high number of children of 'low quality'.

2. Family, Fertility and Female Participation in the Italian Context

In the introduction of this Chapter we underlined that during recent decades social and economic change has taken place simultaneously with changes in demographic behaviour. A strong upgrading in educational attainment and a feminilisation of the labour force are common trends in a variety of industrialised countries and they are related with the decrease of fertility. Nevertheless, each society maintains its own specificities.

In Italy, for example, although the female participation rates increased by about 15% between the 1970s and the 1990s, they still remain very low compared to other European countries (Chesnais, 1996; Del Boca, 1999b). Moreover, there is a great differential between rates for married and unmarried women, with only the latter approaching male participation rates. Some change is emphasised by Jensen (1995), assessing that over time, women's employment has expanded: from quitting a job when marrying, to quitting when having the first child, and finally to today's expectation that women will combine the two roles of mother and worker, interrupting employment only during maternity leaves.

Certainly the market rigidities present in the Italian institutional structure do not facilitate the conciliation of the two roles (Del Boca, 1999b; Golini, 1999). First, the fact that part-time employment is extremely rare in Italy (and often characterised by low profile engagements) is an important factor leading to the low employment rates of married women. Women need to choose between full-time jobs or no job at all (knowing that after quitting the job it is generally difficult to return; see Bernardi, 1999b), neither of which being necessarily their preferred option. Moreover, the general labour market situation may also indirectly affect fertility decision, since parents expect children will stay in the parental home for a long time, at least until they find a stable job and even later on. This has the effect of rising the cost of children.

Another source of rigidity comes from the Italian childcare sector, characterised by a very limited capacity in terms of number of children and weekly hours available, only compatible with part-time jobs (Bernardi, 1999b).

As a result of incompatibility between work and motherhood, empirical findings emphasise that if a woman continues working after having had a child, she has a lower

parity progression probability (see for example Drovandi, 1999; Rampichini and Salvini, 1999, 2001; Moro and Gottard, 1999, on national data, and Ongaro and Salvini, 2002 on data concerning different Italian urbanities). On the other hand, the hazard of quitting the job to become a housewife is particularly high for women in some specific life-cycle stages: some months before marriage, during pregnancy and when children are very young (Bernardi, 1999b).

When work and family are more compatible, this effect is diminished (Rampichini and Salvini, 1999): in Northern Italy, for instance, teachers (who have great flexibility and comparatively few engagements) show higher likelihood to having a child.

As a final element, the strong asymmetry within the family does not help, and women have to shrink their free time to fulfil their duties in the house while working. Therefore, the effect of male characteristics consists almost exclusively of an income effect. Empirical evidence (Ongaro and Salvini, 2002, focusing on transition from first to second child) shows that the educational level of the husband (which may be considered as a proxy for missing income information) impacts on fertility choices, higher educated men having higher chances in bearing another child.

3. Data, Method and Hypotheses

To emphasise the connections between education and labour force participation and fertility in the Turin municipality, we focus on transition from first to second birth. The reason is twofold. First, in modern societies this specific transition constitutes a key point for understanding fertility decline (Frejka, 2002), since the progression to the first child is almost generalised, while a substantially lower proportion moves from one to two children.

Second, focusing on a specific stage of the fertility process enables us to complete the analyses with information on social characteristics of the woman and of the man that would be difficult to include otherwise. Indeed, we may consider the employment status of both the wife and the husband before the birth of the first child as connected to transition to the second child, or even use the working situation before first birth and five years earlier. Notice in this respect that we are not looking for an explanation of the interdependencies between working career and fertility, while we are trying to underline if there have been changes over the 30 years (1970-2000) in some specific aspects. Our data provides indeed only limited information, and it is not possible to reconstruct a detailed event history that would be necessary for the first kind of assessment, for which moreover we may refer to the literature (see for example Drovandi, 1999; Rampichini and Salvini, 1999, 2001; Moro and Gottard, 1999, on national data, and Ongaro and Salvini, 2002 on data concerning different Italian urbanities).

Therefore, our strategy consists of selecting all the women who had the first child about one year after the census (specifically, from 9 months to one year and 3 months later), and to analyse for them the transition to the second child. In this way, for the women we

dispose of the information at the time of the census (recent enough) and five years earlier, in a period preceding the first pregnancy. The time period is upward limited (15 months), since the higher the time since the census, the higher the probability that out-migration occurred, and therefore the higher the chance of focusing analyses on a selected group. Moreover, to consider a homogeneous situation, in which all census information refers to a specific life-cycle stage, we require that marriage is precedent to the census. Therefore, the group we analyse consists of married mothers, who had their first child in a specific period (close to 1971, 1981 and 1991 censuses) and for whom pregnancy was not the reason for marriage.

This situation is represented in the Figure 24.

This particular strategy allows us to use information on the husband, provided that the link between census and register has been successful.

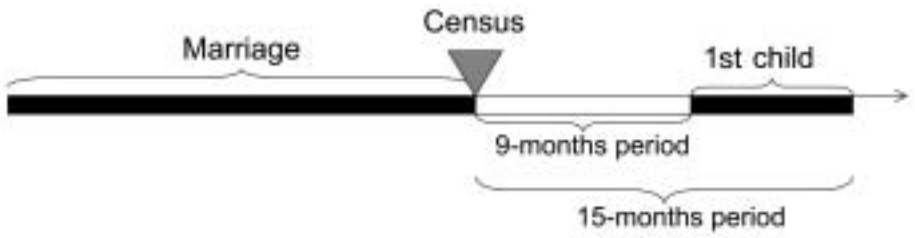
The final dataset consists of about 4,500 women; of these: 2,000 had their first birth around 1971, 1,200 around 1981 and 1,300 around 1991. Then, when we also consider information on the husband, we loose something like 200 observations. Therefore, in models it will be necessary to check that there is not a substantial bias due to selection arising from the inability of linking information on the husband to the woman: we may do this controlling that results obtained with the complete dataset (of 4,500 observations) using information regarding only the women, were consistent with those obtained considering analogous information for the smallest dataset (4,300 observations).

Our main dependent variable is the progression from first to second child, and we describe it through a hazard rate, which in turn depends on some covariates. The comparison of the results for the three distinct periods will provide us a picture of the changes that have occurred over time.

In particular, we hypothesise the logarithm of the risk of having a second child depends on:

- *duration of the exposure* (*baseline duration*) which means time since first child[7];
- *length of the interval between marriage and first child*, hypothesising that the longer the

Figure 24. Time span considered



7. This independent variable is described through a linear spline, which is a continuous function, linear between knots. The knots are defined by the researcher, while the slopes between knots are parameters to be estimated.

interval between marriage and first child, the lower the probability of progressing then in the parity[8];

- *current age of the woman*[9];

- *origin of in-migration* (whenever in-migration has occurred), so as to control for heterogeneity arising from different fertility models[10].

Moreover, we explicitly consider the socioeconomic characteristics of the women:

- *educational level of the woman*[11],

- *employment status of the woman*, expressed alternatively as housewife (reference category), employed, unemployed, student or looking for the first job; or as the previous classification even specifying for the kind of job working women.

and in a second set of models:

- *educational level of the husband*[12],

- *employment status of the husband*[13].

We did not consider the existence of an unobserved heterogeneity component (which represents individual unobserved orientation toward fertility), since we had no time to vary covariates and this situation challenges the chance of identifying the model (see Appendix B). Moreover, we are only trying to focus on the differences over time connected to observed covariates (focusing especially on educational level and employment status) and we want to emphasise the role of these observed covariates in the fertility process. By avoiding to insert an unobserved heterogeneity component, we force the ideational change to pass through observed covariates. The differences in parameter estimates associated to observed covariates shed some light on the changes that have occorred over time. If the parameters linking observed covariates and fertility have changed over time, it means that the variation in fertility levels is not just due to a different composition of the population, but also depends on changes in behaviour and attitudes of the different social groups.

4. Results

During recent decades the characteristics of the population living in the Turin municipality have deeply changed. By comparing for instance the educational level and

8. *Idem*.

9. *Idem*.

10. This independent variable is expressed as a set of dichotomous variables where the reference category is no in-migration.

11. Again, we represent this variable through a set of dichotomous variables for which the reference category is low educational level.

12. As in the case of female educational level, we represent this variable through a set of dichotomous variables for which the reference category is low educational level.

13. Again, we represent the variable through dichotomous variables, considering now being employed as the reference category.

job position of married women who had their first child around the 1971, 1981 and 1991 censuses (*i.e.* the group under study), both the strong upgrading in educational attainment and feminilisation of the labour market are evident. The percentage of these women declaring to be housewives in 1971 amounts to 43%, shifting to much lower values in the following decades (18% and 16%); on the other hand their educational level has increased, and the group of women with a medium or high level has almost doubled (see Table 9). For their husbands, there have not been significant changes concerning the employment status (almost everybody is working), while the upgrading in educational level is similar to that of the wives although less strong. As a result, in 1991 the distribution of the educational level is very similar between husbands and wives, and the percentage of who only attained a low educational level is even higher for men than for women (6% and 4%).

The question if whether the changes in the social composition of the resident population result in a modification of fertility behaviour, that also change the relationship between fertility and education and job, can be answered by observing Table 10.

Our results shed some light on our major question, concerning the link between fertility and social characteristics. Indeed, controlling the length of the interval between marriage and the first child, age at first child, and in-migrant condition, information on the educational level and employment status emphasises changes.

Before focusing on the educational level and occupational status, we consider results for covariates used as control variables. As expected, the older the woman (at least for women older than 30) and the longer the time the couple waited before becoming parents, the lower the probability of conceiving another child. In fact the effect of the length of the interval changes over time, since in 1971 the risk of having a second child reaches its maximum by the 18th month after the birth of the first child, while in the following decades the peak was achieved within about 2 years.

Table 9. Social characteristics of the group under study (%)

	Females			Males		
Period	**1971**	**1981**	**1991**	**1971**	**1981**	**1991**
Educational level						
Low level	52	21	4	44	24	6
Medium level	45	71	83	50	67	80
High level	3	8	13	6	9	14
Employment status						
Employed	55	67	68	99	97	95
Housewives	43	18	16	-	-	-
Students	2	6	10	1	1	2
Unemployed	-*	8	6	-*	2	2
Others	-	-	-	-	-	1

* In 1971 Census the category 'Employed' considers both employed and unemployed people together.

Table 10. Effects of observed covariates on progression to 2nd parity when we consider only the characteristics of the women

	1971			1981			1991		
Intercept									
Intercept	-5.032	***	(0.418)	-5.513	***	(0.975)	-7.724	***	(1.598)
Baseline (duration spline)									
Slope 0-9 months	0.181	***	(0.030)	0.152	***	(0.055)	0.248	***	(0.070)
Slope 9-21 months	-0.010		(0.010)	0.043	**	(0.017)	0.066	***	(0.017)
Slope 21-48 months	-0.001		(0.005)	0.007		(0.006)	-0.001		(0.006)
Slope 48-60 months	-0.016		(0.013)	-0.002		(0.015)	-0.016		(0.016)
Slope > 60 months	-0.028	***	(0.012)	-0.030	***	(0.012)	-0.015		(0.012)
Age at 1st **birth** (regressor spline)									
Slope age < 20	-0.009	**	(0.004)	-0.008		(0.011)	0.003		(0.018)
Slope age 20-25	0.001		(0.002)	-0.001		(0.003)	-0.001		(0.004)
Slope age 25-30	0.001		(0.002)	0.001		(0.003)	0.001		(0.003)
Slope age > 30	-0.011	***	(0.002)	-0.013	***	(0.003)	-0.014	***	(0.002)
Length of interval between marriage and 1st birth									
< 18 months	-0.121		(0.077)	0.034		(0.116)	-0.115		(0.126)
18-30 months	-0.296	***	(0.096)	-0.473	***	(0.136)	-0.233	*	(0.127)
>30 months	-0.816	***	(0.115)	-0.622	***	(0.133)	-0.481	***	(0.133)
Provenience of in-migration (ref.: no in-migration)									
North-Center	0.003		(0.105)	0.224	*	(0.121)	0.147		(0.102)
South	0.457	***	(0.104)	0.265	***	(0.115)	0.131		(0.111)
Foreign country	-0.205		(0.209)	-0.171		(0.301)	0.199		(0.211)
Educational level									
Medium level	-0.047		(0.075)	-0.009		(0.109)	0.037		(0.242)
High level	0.232		(0.181)	0.034		(0.200)	0.638	**	(0.262)
Employment status									
Student	0.058		(0.205)	0.235		(0.181)	0.317	**	(0.171)
Employed	-0.072		(0.067)	-0.131		(0.120)	0.239	***	(0.133)
Unemployed	-0.029		(0.397)	-0.297		(0.179)	0.079		(0.213)

Asymptotic standard errors in parentheses; significance: *=10%; **=5%; ***=1%.

Also the role of in-migration is particularly interesting: coming from the South rises the probability of having a second child for 1971 and 1981 groups, but this covariate is no longer significant in 1991. Having immigrated from a foreign country shifts from having a negative to a positive effect on fertility, although the associated coefficient is never significant. These trends reflect, on the one hand, the high assimilation occurring over time between in-migrant and authoctonous women, mainly due to the quick reduction of

fertility of in-migrants from the South of Italy. On the other hand they emphasise the increasing importance of the groups of foreigners, which in the last decade seem to show a relatively high fertility (see Chapter 3).

Coming back to the main question, we notice that while for 1971 and 1981 there are no differences among women with a low educational level and other women, in 1991 women with a high educational level show a higher probability of progressing to second parity. Our data does not reveal if this is due to an income effect (they may have a higher wage), to a higher compatibility between two roles of mother and worker (we did not check the current working position), or if it is simply the indirect consequence of an analogous characteristic of the husband (the income effect would be male related). The latter hypothesis emphasises the importance of male characteristics, knowing that husband and wives often share the same education (in this respect, Del Boca, 1999a, found for the Italian context strong evidence of the so called *assortative mating*: husband and wives share the same characteristics in terms of educational attainment and employment status).

Moreover, again only for 1991, women who consider themselves as housewifes at the time of the census (*i.e.* in some moment in time between marriage and the conception of the first child) show the lowest propensity in having the second child, while the highest is associated to employed women and students. This may be the result of the relatively negative attitude of housewives and unemployed women toward fertility, or to a relatively positive attitude of employed women and students. If we consider that over time the importance of having a double income and therefore of disposing of high economic resources to afford a new birth has strongly increased, we would explain the attitudes of housewives, unemployed and employed women. The positive attitudes of students toward fertility are somehow less clear, but we may consider that the information refers to a period between marriage and the first child, and that therefore women probably married while studying. In other words, these women broke the social norm requiring that the end of the study precedes entering an union (decision which even respects an economic reasoning), emphasising their positive attitude toward family formation or to the fact that a job for them is not necessary. Nevertheless, the proportion of women they represent is quite limited, reaching 10% in 1991.

What does it happen when we include information on the husband? In other words: has the new condition of women actually changed the link between fertility and socioeconomic characteristics or does this change reflect the effects of the husband's characteristics?

Table 11 shows the new estimates of the parameters associated to socioeconomic characteristics when we insert information on the educational level of the husband[14], while in Table 12 we focus our attention on their social class (determined by combining various information and available only for 1981 and 1991 censuses).

14. When we also considered the employment status of the husband we had very wide confidence intervals, since almost everybody is working at the time of the census, and unemployed conditions may refer to a temporary situation soon modified.

Table 11. Effects of social characteristics on progression to 2nd parity when we consider both the wives' and husband's characteristics

	1971		1981		1991		
Educational level of the wife							
Medium level	-0.018	(0.082)	0.017	(0.111)	0.015		(0.272)
High level	0.183	(0.231)	0.081	(0.217)	0.367		(0.303)
Employment status of the wife							
Student	0.095	(0.211)	0.214	(0.184)	0.322	*	(0.174)
Employed	-0.068	(0.070)	-0.116	(0.121)	0.284	**	(0.136)
Unemployed	-0.010	(0.398)	-0.292	(0.179)	0.163		(0.215)
Educational level of the husband							
Medium level	-0.123 *	(0.076)	-0.101	(0.102)	-0.177		(0.184)
High level	0.038	(0.182)	-0.163	(0.206)	0.361		(0.221)
Ln-L	-16875.66						

Asymptotic standard errors in parentheses; significance: *=10%; **=5%; ***=1%.

Table 12. Effects of social characteristics on progression to 2nd parity when we consider both the wives' and husband's characteristics, including the social class

	1981			1991		
Educational level of the wife						
Medium level	0.063		(0.114)	-0.045		(0.271)
High level	0.085		(0.226)	0.348		(0.304)
Employment status of the wife						
Student	0.161		(0.196)	0.354	**	(0.180)
Employed	-0.124		(0.122)	0.318	**	(0.140)
Unemployed	-0.307	*	(0.179)	0.239		(0.216)
Educational level of the husband						
Medium level	-0.067		(0.106)	-0.217		(0.193)
High level	-0.179		(0.236)	0.131		(0.249)
Social class (ref.: working class)						
Ruling class	0.080		(0.216)	0.337	**	(0.159)
Middle class (white collars)	-0.201	*	(0.121)	0.090		(0.123)
Middle class (others)	-0.056		(0.150)	0.308	**	(0.137)
Ln-L	-8702.80					

Asymptotic standard errors in parentheses; significance: *=10%; **=5%; ***=1%.

When we in the model include the educational level of the husband, the values of the parameters do not change significantly, apart from the fact that the parameter associated to a high educational level of the woman is no longer significant for the 1991

period. The positive effect of having a high female educational level seems to be the result of a (positive) composite effect of high education of both men and women, neither of which is significant. Again, in 1991 being an employed or student woman is associated to a higher rate of transition to the second child. Therefore, the idea that something in the link between socioeconomic characteristics and fertility has changed over time is confirmed, and it seems this happens through the female employment position.

Moreover if we also consider the social class, determined by combining information on the husband (following De Lillo and Schizzerotto, 1985), results change slightly. Again, there are no significant differences among various educational level of the woman, while the effect of the female occupational status does not vanish. On the contrary, in this model, women who in the 1981 census declared themselves as unemployed show a significantly lower propensity to have a second child.

Finally, the working position of the husband is proved to be important: for 1981 very low and very high positions in the social class are associated to higher transition probabilities, while in 1991 being a wife of a white collar or a worker hampers fertility.

If we compare the results we obtained in the first and in the last model (Table 10 and Table 12), the main point is that in 1991 a woman with a job or still being a student is positively associated with fertility, while the effect of female educational level disappears when we include the characteristics of the husband. This result can be due to the fact that the female educational level has not direct effect on fertility, but is associated with the occupation of the husband. As an example, women with a high educational level may have more frequently married men belonging to the ruling class, which show a greater probability of having a second child. Again, the hypothesis that nowadays a double income is increasingly the crucial issue for deciding to have a second child (at least in an urban context) seems to be confirmed.

5. Discussion

Empirical evidence shows that the great changes that occurred in the Turin municipality are associated to social changes over time. Data we have is not enough to understand the mechanisms linking fertility and women labour force participation, but sheds some light on the fact that the situation evolved over time.

In particular, it seems that being a housewife between marriage and the first birth acquires a new meaning over time: while for 1971 we do not find any significant difference with other categories (student, employed, unemployed), in 1981, having a second child, is equivalent to being employed or studying. Besides, nowadays being a housewife constitutes the worst condition for having a second child, together with being unemployed.

Therefore, it seems confirmed that a double income is increasingly the crucial issue for deciding to have a second child (at least in an urban context). As a result, the position

of the husband is important, but we emphasised it is not the only element we need to consider.

The fact that an increasing proportion of women in advanced industrial societies engage in paid work throughout their lives needs a deeper understanding. The critical variable in studies of work-family conflict may no longer be work participation/non participation, but the organisation of work time. Therefore, it would be interesting to consider the exact kind of job in terms of its potential compatibility, rather than the employment status.

Flexible time schedule, the availability of non-marital childcare and even its acceptability may reduce contrasts between these distinct roles, and allow a great possibility of choosing to have children or not.

5. Lowest-Low Fertility in an Urban Context. When Migration Plays a Key Role

In Chapter 3 we underlined many aspects characterising the urban context. Among others, we emphasised the heterogeneous composition of the population, constitut of authocthonous and in-migrants groups, and the strong sub-urbanization and de-urbanization processes which took place during the time span studied.

Both of these aspects may be related with fertility behaviour. On the one hand indeed in-migrants stemming from different areas refer to different fertility models. Once in the Turin municipality, fertility models coexist and may even influence one another. On the other hand, part of the strong out-migration process is related to the relatively high costs of living expenses, combined with income constraints in cities, as compared to these same aspects in rural areas. Finding a suitable and cheap house may become a problem, and more important when the couple decides to have children. Thus, since the needs toward the dwelling change with both the current family composition and fertility plans, even out-migration may be connected with fertility choices.

In this Chapter we therefore study residential fertility for a selected group of women, from the 1956 birth-cohort, even taking into account the interdependencies between residential fertility and migration. In order to fully understand fertility, we need to consider how fertility is related to out-migration choices, and how having in-migrated influences fertility choices.

Our findings underline the important role of economic resources and life cycle events in such a context which seem to guide both residential fertility and migration behaviours. Who show those higher propensity in having children in the centre core of the urban area at the same time evidence the lower propensity of leaving it, and conversely those with a higher wish to leave the city also have a lower propensity to bearing children in the Turin municipality.

The Chapter is structured as follows. In Section 1 we underline the reciprocal impact of migration on fertility and vice-versa, and look at possible common factors which influence both decisions. Section 2 contains a description of the data and the types of models that will be used, while in Section 3 we discuss our main findings, followed by Section 4 where we present our concluding remarks.

1. Migration and Fertility as (Potentially) Interrelated Processes

The study of the interrelationship between fertility and the migration process has mainly focused on two different perspectives. On the one hand, researchers have been

particularly interested in the impact of migration on fertility, studying the fertility of in-migrants, while, on the other hand, current parity and fertility plans were considered among the critical determinants for the decision to move.

1. In-migration and Fertility

Concerning the behaviour of in-migrants, the literature has focused on testing some basic hypothesis which could shed some light on the mechanism that links fertility before and after migration. The major hypotheses were adaptation, disruption and selection. These hypotheses describe different situations. First, adaptation (Goldstein and Goldstein, 1981; Stephen and Bean, 1992) predicts a gradual assimilation to fertility norms and behaviour of the host society. Second, disruption considers only a temporary effect of migration, which depresses fertility in the first period after the move, because of spousal separation or the settling-in process (Carlson, 1985). Finally, selection (Hervitz, 1985; Kahn, 1994) stresses that migrants are selected through socioeconomic characteristics, which in turn also influence fertility behaviour: when checking for these characteristics, no difference is expected between migrants and non-migrants.

The literature has mainly tested these three hypotheses with respect to the urbanisation process itself (studying in-migrants fertility), both in developing and industrialised countries, focusing on urban and rural differentials. In addition, some studies have focused on multicultural countries, such as the United States and Australia, where consistent international migration flows contribute to define the overall fertility levels (therefore, attention was focused on immigrant behaviour). For instance, Ware (1975), Carlson (1985) and Abbasi Shavazi and McDonald (2000, 2002) studied the fertility behaviour of Australian immigrants; Ford (1990), Stephen and Bean (1992) and Kahn (1994) focused their attention on the United States; while Hervitz (1985) dealt with Brazil; and Goldstein (1973) and Zarate and De Zarate (1975) considered the urbanisation process in developing countries.

Assimilation seems to be the main confirmed hypothesis for international immigration: evidence is found for instance by Ford (1990); Hervitz (1985); Abbasi Shavazi and McDonald (2000, 2002), the degree of assimilation depending on the cultural distance between the origin and destination countries, ethnic concentration and the kind of social interaction performed in the host country. Together with this hypothesis, disruption was found by Carlson (1985).

Conversely, for rural to urban moves, selection and again assimilation play an important role for determining fertility behaviour (Goldstein, 1973; Zarate and De Zarate, 1975). Moreover, it may be that this kind of move is associated to a catching-up fertility, since the move can for example be associated to a marriage, and married people have higher fertility than the unmarried. This corresponds to higher fertility levels, especially at the beginning of the period following in-migration.

In the context of lowest-low fertility, the analysis of the fertility of in-migrants can be of major interest. Since national fertility levels are very low, it may be interesting to understand how different fertility models coexist, and how the immigrant population

(often characterised by higher fertility levels) is integrated in the host society. A similar analysis with data concerning the Turin municipality may allow for an understanding of the impact of external conditions (changed due to migration) on fertility behaviour in an urban context.

2. Fertility and Out-migration

In the literature concerning migration, particular emphasis has been given to life-cycle events as possible determinants of the decision to move (Courgeau, 1984). This follows the pioneering idea expressed by Lee (1966), that migration can be considered as an instrumental behaviour for achieving specific goals in some other parallel careers.

In this respect, the 'household career' acts as a push and pull factor for the decision to move. The household career can, on the one hand, define constraints for the move, being then a conditioning career (Mulder, 2000). Long (1972) demonstrated that married couples without children are more geographically mobile than married couples with children, where mobility is even more restricted during school ages. Children create ties with current location and within the members of the family itself, and this can hamper migration. If a family has to move, the net family gain will be evaluated, instead of personal gain (Mincer, 1978).

On the other hand, the need to adjust housing to changes in the household composition is an important source of mobility (Grundy, 1986; Baizan, 2002), and residential mobility can thus be a possible response to fertility and fertility plans.

The latter push factor can then be very strong in the core centre of an urban area, where spacious single family dwelling units are not easily available and, when available, present very high costs in comparison to their quality. Internal dynamics of the city, in this respect, play an important role. A process of 'gentrification' (that means revaluation of some part of the city, shifting from a low-income area to a middle-class area) further increases the costs of a home in a specific zone, and tenure is even more difficult (Zukin, 1987). Moreover, related to expansion of the urban service economy, some residential buildings have been converted to service use, resulting in lower availability of dwellings, with higher prices.

3. Factors that May Simultaneously Influence Both Fertility and Out-migration

Besides the direct effects of fertility on migration decisions, we also need to take into account some factors that could potentially influence both processes at the same time. We may for instance consider personal attitudes toward fertility and toward the perception of life in Turin, attitudes that may even be correlated with each other and result in making the population heterogeneous. Since in our data these elements are not observed, we refer to them as unobserved components, on the basis of which the population is heterogeneous (therefore we sometimes speak of unobserved heterogeneity).

The basic idea is that although we do observe many characteristics of each individual, useful for understanding differences in the way people experience events, there is still

something unobserved, namely a person-specific attitude, that we need to take into account. For instance, the age of the woman or the number of children she already had is important to predict if she will have another child, as well as her attitude toward fertility: if a woman wants to strongly invest in her career, she will show a lower probability of bearing a child than a person who desires to have a big family.

Even in the literature many scholars pointed out the existence of unobserved heterogeneity, especially in the fertility process (Gini, 1924; Heckman and Walker, 1999). In general, it is supposed that differences among women in unobserved fecundity result in unobserved heterogeneity, which in turn represents a degree in propensity of women in having children. In modern societies, where fertility is perceived as a real choice, we can think that people's attitudes toward the family, *i.e.* the degree to which people are actually family-oriented, is an important element we need to consider.

Similarly, even in the case of the migration phenomenon, many authors included in their models the unobserved heterogeneity (attitudes and values) in the propensity of moving (Blumen *et al.*, 1955; Spilerman, 1972; Davies *et al.*, 1982).

In the present Chapter we are dealing with the urban context, and therefore we have to consider the meaning of these 'unobserved factors' (*i.e.* factors which generate a higher or lower propensity of having children and of leaving the core centre) in this peculiar situation. Heterogeneity in fertility behaviour for instance does not directly describe a lower or higher propensity of having children in general, but of having children in the Turin municipality. Heterogeneity in out-migration preferences is related to the lower or higher propensity of leaving the core of the urban centre. Due to the particular characteristics of the housing market and the existence of residential norms, unobserved components which impact on fertility behaviour may be related to unobserved factors underlying out-migration decisions. To explain this important point, let's proceed by steps.

First, we have to consider that in the centre core of the urban area, the housing market is different than in other areas of the same province. High quality dwellings are more expensive in the centre than in the suburbs, ownership is more difficult, and finding a big house for big families is harder than in the surrounding areas.

This situation may constitute a problem, especially when we consider that, as emphasised by Mulder and Hooimeijer (1999), the importance of the residential environment increases according to the rising size of the family, since married couples, and in particular those with children, financially invest more and more in the family. Therefore, the quality of the dwelling and its environment has to be high, and for the same reason, ownership is preferred to renting.

Rather than minimal requirements for health and safety, preferences reflect the existence of some commonly held norms (Speare, 1970; Landale and Guest, 1985). Housing norms, for example, prescribe that housing should be owned by the occupants, be of an independent structure, have sufficient outdoor and indoor space, given the age and sex composition of the family (Morris *et al.*, 1976; McAuley and Nutty, 1982). Cultural and family sequential norms moreover require reaching residential stability before having children (Baizan, 2002).

All of these elements discourage family formation in the central city, which remains generally the preferred location among young singles and couples with no children, but looses attractiveness during family formation, childbearing and child rearing life-cycle stages. Many researchers in the United States believe that housing market conditions, high levels of crime and segregation, all contribute to outflows from the central city of important metropolitan areas. This is especially so for families rather than for single persons (Frey and Kobrin, 1982; South and Crowder, 1997), assessing that the central city does not svit family formation stages. Despite the fact that American cities are different to European ones, this gives support to the idea that migration can become a possible strategy for those who desire or intend to have children.

What may indeed happen is that the decision to migrate becomes part of the strategy leading to having children. This means that moves are not only influenced by current household situations, but also by individual desires for children and by the importance attached to cultural and social norms.

Therefore, by classifying the population in accordance to their unobserved propensity to having a child and of experiencing an out-migration event, we may find four different situations, represented in Table 13.

Indeed, we may find that people with a higher propensity to leaving the city, also have a higher propensity to bearing children in the Turin municipality (A). We may consider this group as family oriented, and due to this strong attitude to having children, they prefer to leave the city for a better environment (Mulder, 1993). On the contrary, if they do not experience a strong desire to have children, they may find the city to be a good place to live: we are therefore in a second situation (B), where low propensity to leave the city is combined with a low propensity to having children. In both the situations, the attitude in becoming parents prevails on the attachment to the city.

A third situation (C) associates who has a lower inclination to leaving the city with a higher propensity to having children. In this case the attachment to the city prevails, and those who like the city more, find it a good place for bearing children (Speare, 1974). Again, the opposite situation (D) consists of people who on the one hand have a high desire to leave the city, and on the other, experience a low inclination to having children. The decision of having children seems to depend on the perception of the quality of life in the Turin municipality.

Table 13. Possible relations between unobserved propensity to experiencing out-migration and fertility events

	High propensity to out-migrate	**Low propensity to out-migrate**
High propensity to have children	A	C
Low propensity to have children	D	B

If the positive association between unobserved components prevals in the population, we can interpret heterogeneity in the fertility process as a measure of the degree to which people are actually family-oriented. Therefore, we would say that more family-oriented people would willingly leave the city than less family-oriented people, according to Mulder's interpretation (1993). That is, family-oriented households would be more likely to search for locations suitable for child welfare and family living than those households who are not so oriented (Sabagh *et al.*, 1969).

On the contrary, a negative association may prevail. In this case, emphasis is thus given to the perception of quality of life in the Turin municipality, or in a specific neighbourhood, for each woman (Speare, 1974). Satisfaction with the residential environment and with established ties with the city are possible determinants of intra-metropolitan residential mobility. Thus, those who like the city more, find it to be a good place for bearing children, while whoever does not like to live in the city depresses his/her fertility. This confirms Grundy's (1986) idea assessing that 'a reluctance or inability to move to larger accommodations may, in some circumstances, depress fertility, and the availability of housing may affect any relationship between mobility and fertility' (Grundy, 1986).

The main question we would like to answer is, therefore, if in the particular case of a central city, are these processes really interrelated, and in which way? With this aim in mind, some characteristics of data and methods will now be presented.

2. Data and Methods

For the present study, we focus our attention on women born in 1955 and 1956, for whom we follow their entire reproductive period (at the beginning of the 1970s they were 15 years old, and 44-45 in 2000). Since our main goal is to study urban fertility and to concentrate on the impact of forming a family and having children on migration behaviour, we have then selected only women who resided in the Turin municipality, at least since their 15th birthday. In this way we can be assured that at the (theoretical) beginning of the reproductive period, all the women were already in Turin, and therefore fertility choices were directly influenced only by the urban context (as well as searching for a mate, finding a job, or other form of adult behaviour in general). In-migrants can then be considered homogeneous in respect to the life-cycle stage during which in-migration occurred, since this took place for everyone during childhood. In this way we avoid lack of control for the interrelation between in-migration and family formation (Andersson, 2001).

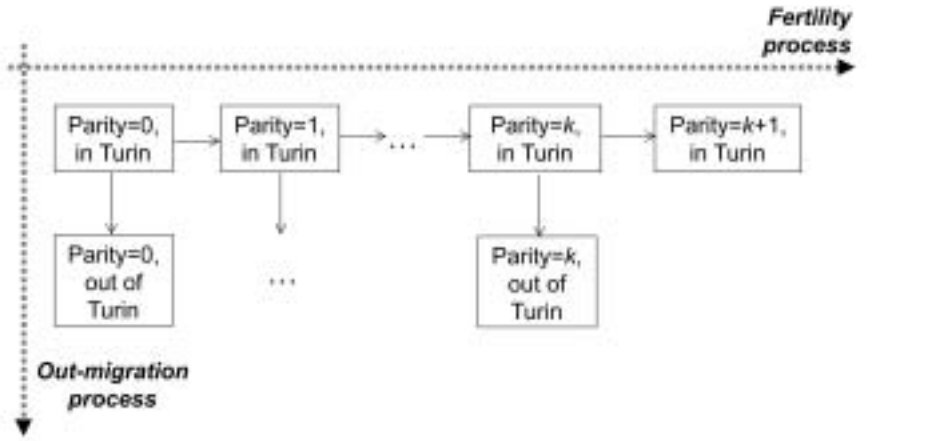
For these women we focus our attention on the period following marriage, explicitly selecting people who lived in Turin at least until marriage, so that changes in this choice are only due to a change in marital status and household situation. Considering the peculiarity of the Italian situation, this allows us to photograph their entire fertility history. Since fertility in Italy is almost completely marital (Castiglioni and Dalla Zuanna, 1994; Billari *et al.*, 2002), we can deal with the first trigger for migration since marriage and

leaving the parental home usually happen simultaneously in Italy (Billari, 2001)[15]. The final data set consists of 7,623 women, born in 1955 or 1956, who married at some point in time before 2000.

For all women we have information both on out-migration and on fertility history until censoring sets in (which corresponds to death, out-migration or the end of 2000). We only take into account the period after marriage. At the beginning of the marriage, each woman has no children. Then, she may have the first child (transition from parity 0 to parity 1 occurs), or she may leave the Turin municipality still with parity 0. Fertility history is censored at the same time as out-migration occurs. In Figure 25, each arrow shows a possible transition, which may be transition from a lower to a higher parity (horizontal arrow) or from residence in the Turin municipality to residence out-of Turin municipality (vertical arrow). Note in this respect that out-migration automatically leads to the censoring of the observation, and since we hypothesised that the two processes are linked through both observed and unobserved factors, the censoring event is supposed to be correlated with the phenomenon under study.

A possible solution allowing us to take into account this issue, and the existence of heterogeneity factors in the analyses, is to use a structural equation for event history models. This allows us to simultaneously consider more equations, including in each some unobserved component that in principle can also be correlated (see for example Lillard, 1993; Lillard and Waite, 1993; Lillard and Panis, 2000). We remind that the unobserved component refers to the unobserved heterogeneity in the propensity to

Figure 25. Out-migration as a censoring event for fertility



15. Moreover, since we are analysing data coming basically from Turin register that allow us to have information on the period until out-migration occurs, if we would consider out-migration in general, we would lack controlling all out-migrations in which marriage occurred a short time after the move.

experiencing an event in the fertility process and an out-migration. Since we study two processes (fertility and out-migration) we will use two simultaneous equations, the first describing fertility, and the second out-migration.

In general, we model the logarithm of the hazard rate as follows:

$$\ln (h(t)) = y(t) + \sum_k z_k (u_k + t) + \sum_j a_j x_j + \sum_i b_i w_j (t) + \varepsilon$$

where $y(t)$ is a function which describes the logarithm of the risk, according to the duration of the exposure; each $z_k (u_k + t)$ represents the dependence on another dimension of time (for example the current age of the woman), whose value can be completely predicted since their value at the beginning of the exposure (u_k) is known. These functions of time are linear splines: we fix some knots, while the shape is estimated supposing a linear trend between knots. To describe the time dependence via spline is particularly flexible since entirely different shapes can be represented with the same parametric function.
Moreover, we also consider other time constant (x_j) and time varying covariates ($w_i (t)$) whose effect is to shift the baseline hazard proportionally. The final component (ε) denotes an unobserved component which is constant over time and specific to each unit. If we assign ε_r and ε_q to the two components for the processes r and q, where r represents fertility and q out-migration, we can write their joint distribution, since it is assumed we follow a bi-variate normal distribution:

$$\begin{pmatrix} \varepsilon_q \\ \varepsilon_r \end{pmatrix} \sim N \left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_q^2 & \sigma_{r,q} \\ \sigma_{r,q} & \sigma_r^2 \end{pmatrix} \right)$$

Both the variances (σ_r^2, σ_q^2) and the correlation between heterogeneity terms ($\rho_{r,q}$ which follows from the covariance) are estimated by the model.

In each equation a parameter estimates the degree of the unobserved heterogeneity. The correlation coefficient between the two unobserved components represents how the heterogeneity in fertility process and in the out-migration are related to each other.
A positive correlation would mean that in general women with higher unobserved propensity to having a child also have an higher unobserved propensity of out-migrating, confirming Mulder's interpretation (1993), assessing that family-oriented households would be more likely to search for locations suitable for child welfare and family living than those households who are not so oriented (Sabagh *et al.*, 1969). On the contrary, a negative correlation would mean that emphasis is given to the perception of quality of life in the Turin municipality (Speare, 1974). Thus, those who like the city more, find it to be a good place for bearing children, while whoever does not like to live in the city may depress his/her fertility, thereby confirming Grundy's idea (1986).
A null correlation coefficient would mean that the two strengths cancel each other out.

This particular way of describing each process allows the inclusion of unobserved factors influencing fertility and others that affect the probability of migrating.
In the following subsections we will describe in more detail the equations representing fertility and migration, leaving the description of results for the next section.

1. The Equation Describing Fertility

Childbirths are repeatable events, but each birth is a step with a more complex strategy. The decision-making model – to which we refer – assumes that women act rationally to realise a plan of desired family size (Becker, 1981). Since different strategies can be compatible with the same number of children, women can choose to act in different ways, and observing how the process evolves can add information on the process as a whole (Yamaguchi and Ferguson, 1995; Rosina, 2001). Therefore, when describing fertility, information concerning the past of the process needs to be considered in order to predict its future.
The basic event of interest is a new birth. We keep the hazard relative to first parity distinct from transition to higher parities, since the former event represents the entry into motherhood while, for the others, the fertility process already began (unlike Yamaguchi and Ferguson, 1995, we also consider transition to first birth)[16].
Apart from the first child, the *length of previous interval* gives additional information in the understanding of subsequent fertility. Murphy (1999), for example, includes various possible meanings of the interval between births: 'physiological difficulties in conceiving, continuity in terms of contraceptive usage, possible episodes of spousal separation, low coital frequency, stable attitudes to appropriate birth-interval length, and constraining and socialisation factors due to differing educational and employment histories.' Obviously we have to distinguish the first interval from the subsequent, thinking that a short interval between two births predicts shorter spacing to the next one (Yamaguchi and Ferguson, 1995), while the interval between marriage and first birth reflects the choice to enter motherhood. Therefore, if the last length is very short, as in the case of a pregnancy-caused marriage, it is possible that there was no real intention to start the reproductive period, and hence to consciously proceed to higher parity.
Moreover, the *age of the woman* at the beginning of each birth interval can be significant (Marini, 1981). One possible reason is that a woman who started to be at risk (that means who married or had a child of parity *j*) at very young age will have a long time to conceive an additional child. She will also have a higher fecundity, and we can associate a higher probability of progression to a higher parity. On the other hand, she may decide to postpone the event, until she has more time.

16. In the general equation, we build the baseline risk as the risk associated with the duration of the exposure, which starts nine months after the birth of the child of order j-1 for a child of order j, or at time of marriage for the first child. Moreover, since we can not consider the risk of having a first child similar to the risk of having an additional child, we specify two different baselines: the first one is associated to the risk of entering motherhood, while the second describes the hazard of having an additional birth. Then, we check for current parity considering a specific coefficient for each birth order.

In the literature it has been found that if a woman is very young when she starts building her family, she will show shorter intervals between her births and a high level of complete fertility (*e.g.* Hoem and Hoem, 1989). The latter phenomenon is known as the 'engine of fertility' (Rodriguez *et al.*, 1984) and it can be associated with a strong investment in family formation. This is due to family building that begins at very early ages, or to a conscious desire to attain a larger family size by a certain age (Yamaguchi and Ferguson, 1995).

We model the effect of age at marriage on the first birth, as a linear spline with three knots, corresponding to ages 20, 23 and 26. The basic idea is that a very early age at marriage is associated with a high probability of conceiving a first child, and then the probability declines (so we expect a negative slope for age 15-20). Ages 20, 23 and 26 represent quite defined situations, since around these ages, 25, 50 and 75 per cent of the women under observation are already married, and therefore we can consider the two more extreme groups as people 'anticipating' or 'delaying' marriage.

For subsequent births, we expect that the effect always follows in the same direction, *i.e.* that the older the woman, the lower her probability of conceiving a child[17].

As a final variable describing previous fertility, we also include the possibility that the last pregnancy led to *twins*, because in this case women may have a strong wish to wait for a long time before a new pregnancy (Strandberg and Hoem, 2002). Rosenzweig and Wolpin (1980) demonstrated, for example, that having had twins at parity one represents mainly a time shift of subsequent fertility, although this has only a negligible impact on completed family size.

All the variables included up to this point refer to the history of the fertility process, and their effects are thought to be analogous to other contexts. The following characteristics are particularly important in this specific context. We consider that if the woman had *in-migrated*, and we checked for *educational level*, both in interaction with parity. Indeed, in the urban context the constraints for facing a new birth are higher, and therefore both the availability of a high level of resources and the reference to a fertility model which prescribes higher fertility may play an important role in fertility decisions.

We expect higher fertility rates for in-migrants (since most in-migrant women belong to regions in which fertility is higher than in Turin). This effect can be constant in respect to parity (in-migrants maintain their fertility preferences in the new society), or vanish gradually for higher parity (in-migrants adapt to the host society).

Concerning the educational level, the result is, in principle, difficult to predict for two reasons. First, the relationship between the educational level and fertility is itself quite ambiguous, since it is the result of the balance between opportunity costs of rearing children and the possibility of doing so (Becker, 1981c). Women with a high educational level have a higher earning potential in the labour market, which in turn increases the

17. Since we expect the effect of the age of the woman at the beginning of the exposure to bear the *j*-th child (*i.e.* 9 months after the birth of the child of order *j*-1) is different for each birth order, we also considered different coefficients for each parity.

relative costs of children and therefore reduces the demand for children. Women may spend more time in education, and this delays their entry into marriage (Blossfeld and Huinink, 1991), although it is not clear whether entry into motherhood is affected directly. On the other hand, a high level of education is associated with a high income level, which defines the economic resources for facing new births. While in the past, opportunity costs of childbearing for women were assumed to more than compensate for the income effect (and the opposite for men), in recent years, a positive effect of a mother's education on fertility was found, at least for high parities. For the first parity Marini (1984) and Liefbroer and Corjin (1999) demonstrated that both educational attainment and labour force participation have a negative impact on women, which is stronger for entry into motherhood than for entering a union. This suggests incompatibility between having the first child and being employed or having invested heavily in human capital. Other studies (see for example Hoem and Hoem, 1989; Kravdal, 1992) pointed out that for the second and the third parity, controlling for other covariates, women who have higher education also have higher relative fertility. This effect seems, however, to disappear considering that each woman has a specific propensity having children: in other words, if we consider the heterogeneity of the women in experiencing fertility, no differences are found by educational level are found (Kravdal, 2001).

Beyond these general considerations, we also need to take into account the fact that in the urban context the availability of economic resources is more important than elsewhere, and therefore we can expect that a high level of education raises the probability of having an additional child for high parities.

2. The Equation Describing Out-migration

We have previously underlined the effect of current parity and desired fertility as a possible reason for migrating. In this context, we would like to concentrate on the effect of demographic variables on migration. In particular, we focus on how the migration choices of married couples are related to their fertility.

The main variables will therefore deal with the household situation. The baseline risk will measure the risk of migrating as a function of *marriage duration*. The shorter the marriage, the higher the probability of migration, since the new household situation probably altered residential preferences and needs (Mulder, 1993), and since marriage very often coincides with leaving the parental home in Italy (Billari, 2001). Delays in registering residential changes can cause strong dependence with the duration of marriage.

Residential adjustment can then be necessary whenever the current location is no longer suitable to family size. According to the *number of children*, larger families will probably try to find better and cheaper accommodation, and move (Mulder and Hooimeijer, 1999). But if children are of school age, this increases ties with the current location (Long, 1972). We control for the *current age of the woman*, which may represent both the resistance and the chances to moving. In this respect Landale and Guest (1985), for example, found that, even controlling for family life-cycle stages and residential satisfaction, a low propensity to move is associated with ages higher than 46. The idea is therefore that we

can attribute an 'attrition effect' to age: the resistance to moving may increase with age. However, it may also happen that very young women also have few possibilities of moving due to the lack of economic resources.

Apart from the household career, we consider additional information, such as *being an in-migrant or not*, distinguishing then also by the *provenience of in-migration* (Turin province, North-Centre Italy or South Italy and foreign countries). In general we would expect that previous moves enhance next moves (because of fewer ties with the Turin municipality), but this may differ by provenience. Moreover, we control for the *educational level*[18]. The latter variable (related to *job position*, which can be very important for the analysis of migration behaviour, as underlined by Long, 1974; Sandefur and Scott, 1981; Da Vanzo, 1981) represents the possibility of moving, influencing the extent to which people wanting to move can fulfil their wish, and on the other hand, the possibility of staying. Therefore, its effect is not easily predictable.

3. Results

Results are shown in Tables 14, 15, 16 and 17. In Table 14, we present the parameters for the fertility process; in Table 15 and Table 16 we report the analysis for migration and in Table 17 we consider fertility and migration as interdependent processes, allowing also for correlation between the unobserved components. We consider only three basic models for fertility and for migration: the first one describes each process with limited information, the second includes all observed covariates, while only the third considers the existence of an unobserved heterogeneity component. Regarding the out-migration process, we distinguish by destination of the move, in a competing risk model, to underline differences in the processes. We also comment on these results (shown in Table 16), discussing out-migration in general. Finally, both fertility and out-migration processes are considered as a whole system.

1. Fertility

In discussing results, we will first focus on how the individual history of fertility influences the following events, then analyse other control variables and, finally, describe the

18. This variable is not decreasing over time (since only upward levels can be obtained) and it is moreover almost steady after marriage. It is a well-known fact that education is hardly compatible with adult roles, especially in Italy and Spain, and that both social norms and economic reasons push people to end education before marrying (see for example Blossfeld and Huinink, 1991, for the general idea, and Blossfeld De Rose, 1992, and Coppola, 2002, concerning the Italian case). Selecting the maximum/best educational attainment ever registered in any data source (register or censuses), we will therefore attribute the true educational level obtained before marriage.
It would anyway be interesting to include in-migration analysis information toward the occupational status and the working career of both the woman and the man in the couple, but since we expect that changes in jobs, current working positions (or the current working position) and characteristics of the dwelling have a 'continuous effect' on determining migration chances and triggers, the available data from censuses is not enough. This data is collected indeed every 10 years, and we have it only if at the time of the census the subjects of study were residing in Turin.

Table 14. Results for fertility model

		Model 1		Model 2		Model 3	
		Estimate	**s.e.**	**Estimate**	**s.e.**	**Estimate**	**s.e.**
Current parity (ref.: parity=1)							
Parity=2		-1.5424 ***	(0.0517)	0.0583	(0.2114)	-0.1135	(0.2253)
Parity=3		-1.6436 ***	(0.1511)	0.2435	(0.3776)	-0.2003	(0.3978)
Age at marriage (regressor spline for 1st birth)							
Slope age 15-23				-0.0137 ***	(0.0009)	-0.0160 ***	(0.0011)
Slope age 23-26				0.0025 *	(0.0014)	0.0028 *	(0.0015)
Slope age >26				-0.0043 ***	(0.0007)	-0.0043 ***	(0.0008)
Age at previous birth (regressor spline, no knots)							
Effect of age at 1st birth on 2nd birth				-0.0034 ***	(0.0005)	-0.0043 ***	(0.0005)
Effect of age at 2nd birth on 3rd birth				-0.0088 ***	(0.0010)	-0.0085 ***	(0.0010)
Length of previous interval (regressor spline)							
Marriage-1st birth	<12 months			0.0435 ***	(0.0129)	0.0621 ***	(0.0149)
	>12 months			-0.0120 ***	(0.0011)	-0.0073 ***	(0.0016)
Previous births	Slope			-0.0182 ***	(0.0027)	-0.0166 ***	(0.0028)
Being immigrated or not (ref.: not immigrant) (int. with parity)							
Being immigrated, no children				0.2530 ***	(0.0308)	0.2963 ***	(0.0363)
Being immigrated, one child				0.1558 ***	(0.0425)	0.1972 ***	(0.0467)
Being immigrated, two children				0.0482	(0.1076)	0.0989	(0.1117)
Being immigrated, higher parity				-0.2671	(0.3320)	-0.1939	(0.3282)
Twins as last parity (ref.: no twins)							
Twins = yes				-0.4504	(0.2800)	-0.2857	(0.2917)
Educational level (ref.: low) (int. with parity)							
Parity=0	Medium level			-0.2728 ***	(0.0499)	-0.3063 ***	(0.0545)
	High level			-0.2885 ***	(0.0666)	-0.3404 ***	(0.0749)
Parity=1	Medium level			-0.2582 ***	(0.0519)	-0.3231 ***	(0.0588)
	High level			0.3458 ***	(0.0864)	0.3302 ***	(0.0943)
Parity=2	Medium level			-0.0351	(0.1241)	-0.1154	(0.1305)
	High level			0.5247 **	(0.2180)	0.4615 **	(0.2248)
Parity>2	Medium level			-0.3221	(0.2934)	-0.3794	(0.2923)
	High level			-0.7399	(0.6496)	-0.7596	(0.6478)
Variance of the heterogeneity component							
Sigma-fertility						0.4747 ***	(0.0582)
Ln-L		-66978.6		-66114.2		-66100.9	

Asymptotic standard errors in parentheses; significance: *=10%; **=5%; ***=1%.

impact of unobserved heterogeneity. Again, we remind readers that we analyse the risk of having a child, taking into account both first and the subsequent parity.

In general, not only is the number of children important for the prediction of subsequent fertility (the higher the parity, the lower the risk of having an additional child), but also time spacing between births (Yamaguchi and Ferguson, 1995). We assumed a different effect on the length of the previous interval for the first birth and for subsequent births, distinguishing between protogenesic and intergenesic intervals. As expected, if we consider intervals between births (*i.e.* integenesic intervals), the general effect is that the longer the previous interval, the lower the probability of conceiving a new child. This holds also for the protogenesic interval, when the interval between marriage and the first child is longer than 9 months. Conversely, if the first child is the result of a premarital conception (*i.e.* the protogenesic interval is shorter than 9 months), the lower the interval, the lower the probability of conceiving again. This is consistent with our hypothesis concerning the fact that a premarital conception reflects a somehow unintended fertility, and therefore it does not correspond to a conscious intention to proceed to higher parity. The same finding has been obtained on Italian data by Rosina (2001).

If the last pregnancy led to twins, the fear of repeating the experience (in terms of time and energy spent with more than one child at a same time) has a negative, although not significant, effect on subsequent fertility.

Another important aspect we included in the analysis consists of the age of the woman at previous child-birth or at marriage, considered specifically for each order of birth. According to previous results (see for example Hoem and Hoem, 1989) age at marriage shows how women who marry at very early ages have the highest probability of having at least one child, while women who marry quite late (at least later than 75% of the same cohort) also delay motherhood.

For other parities, and as expected, the older the woman the lower the probability of bearing a new child, and the effect is stronger for higher parities (Murphy, 1999).

The behaviour of in-migrant women is particularly interesting. At the beginning of their reproductive period they significantly differ from autochthones, showing higher propensity to bearing a first child, and also a second one. With the increase of parity, they seem to conform more closely to Turin's population. These results would support the *adaptation hypothesis* (Goldstein and Goldstein, 1981; Bean and Swicegood, 1985): adaptation to the new economic, social and cultural environments at place of destination, leads also to a change in fertility preferences among migrants (Hervitz, 1985).

Also, the effect of the educational level changes according to parity. For the first parity, the lower the educational level, the higher the probability of having a child. Conversely, a U-shaped effect emerges for transition to parity two and parity three. Reaching parity four is then not dependent on the educational level. In other words, while low educated women show a higher probability of having the first child, it seems that the most favourable situation for those who intend having two or more children is having a high educational level. This result supports the hypothesis that in the urban area, in order to proceed to high parities, it is particularly important to dispose of high levels of resources.

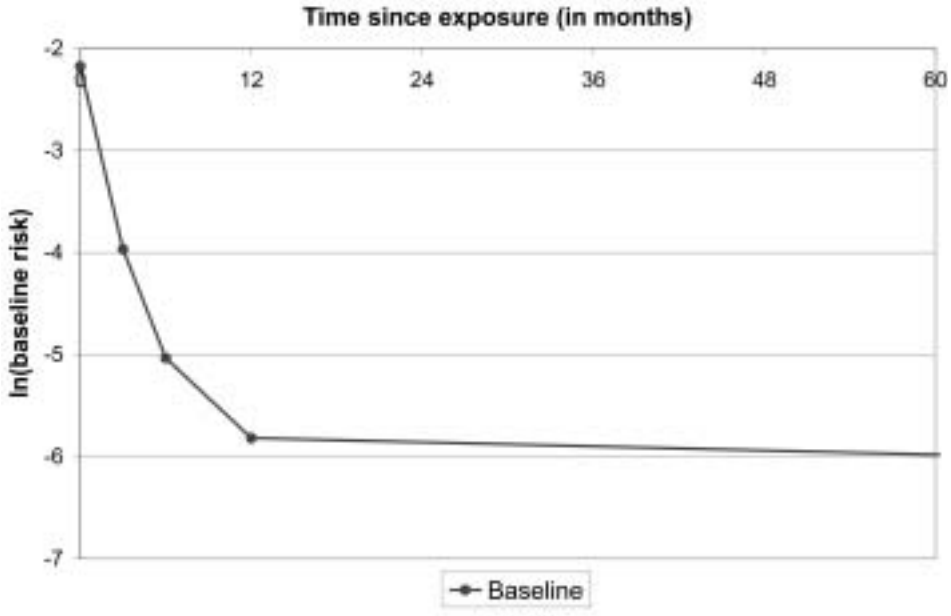
2. Models for Out-migration

Out-migrations from the Turin municipality are strongly conditioned by demographic events. As shown in Figure 26, in the very first months of marriage, out-migrations occur with the highest probability.

After one year the risk of leaving the Turin municipality declines only slightly with the length of marriage. This trend is common to both short- and long-distance moves, but it corresponds more closely to the first kind. According to Grundy and Fox (1985) and Mulder and Wagner (1993), residential adjustment seems then to be a consequence of marriage itself. The need to find a suitable house for the couple and its future children pushes people to leave the core centre of Turin, and this underlines the fact that probably Turin municipality' environment is not suitable to childrearing, and to respect residential norms (Baizan, 2002) the best solution seems to leave the city. Indeed, we have to recall that we are not studying residential moves in general, but only out-migration from the Turin municipality. As already underlined by Occelli (1993), Turin residential situation is one of the worst compared to other areas of Piedmont, and people are often unsatisfied about their own accommodation. Thus, in correspondence to marriage the city experiences a first consistent out-flow.

After marriage, other demographic events are associated to a rise in the probability of leaving the city. Indeed, while having one child seems to significantly discourage out-migration, this is not so for a higher number of children (in respect to having no children, the associated coefficient is the only one negative and significant, while for higher

Figure 26. Baselines risks for out-migration process



parities, the coefficients are no longer significant, and even become positive). When the number of children increases, the push factor more than compensates the pull factor: having children, more than constituting a tie with the core centre, is a reason for leaving it. Nevertheless, if children are school aged, this creates ties with the place of residence, hampering the possibility of leaving. When we distinguish by destination (Table 16), the effect of parity differs slightly: the negative impact of parity hampers only long-distance migration, and also having school-aged children has a stronger negative impact on this destination.

Another element which can discourage mobility is age: after the age of 40, the probability of moving drops, probably because people have already settled-down (Landale and

Table 15. Results for out-migration model

	Model 1		Model 2		Model 3	
	Estimate	**s.e.**	**Estimate**	**s.e.**	**Estimate**	**s.e.**
Current parity (ref.: parity = 0)						
Parity = 1	-0.1175 **	(0.0548)	-0.1138 **	(0.0558)	-0.1226 **	(0.0580)
Parity = 2	-0.1082	(0.0672)	-0.0463	(0.0733)	-0.0545	(0.0773)
Parity >2	0.0209	(0.1135)	0.0921	(0.1198)	0.0961	(0.1287)
Current age of the woman (duration spline)						
Slope age 15-17	0.0791 ***	(0.0297)	0.0798 ***	(0.0291)	0.0814 ***	(0.0296)
Slope age 17-30	0.0001	(0.0005)	0.0022 ***	(0.0005)	0.0026 ***	(0.0006)
Slope age 30-40	-0.0048 ***	(0.0008)	-0.0032 ***	(0.0008)	-0.0031 ***	(0.0008)
Slope age >40	-0.0107 ***	(0.0025)	-0.0105 ***	(0.0026)	-0.0112 ***	(0.0026)
Having school aged children (ref.: no)						
Having school aged children			-0.1811 ***	(0.0655)	-0.1857 ***	(0.0662)
Educational level (ref.: low)						
Medium level			-0.3884 ***	(0.0477)	-0.4489 ***	(0.0567)
High level			-1.5051 ***	(0.0992)	-1.7008 ***	(0.1204)
Provenience of immigration (ref.: non immigrated)						
Turin province			0.0797	(0.0598)	0.0827	(0.0688)
North-Centre Italy			0.1173 **	(0.0528)	0.1322 **	(0.0614)
South Italy			-0.1511 ***	(0.0426)	-0.1880 ***	(0.0512)
Foreign countries			0.1220	(0.1204)	0.1277	(0.1391)
Variance of the heterogeneity component						
Sigma-out-migration					0.7145 ***	(0.1088)
Ln-L	-31505.1		-31358.2		-31356.3	

Asymptotic standard errors in parentheses; significance: *=10%; **=5%; ***=1%.

Table 16. Results for out-migration model distinguishing by destination

Destination:	Turin province		Other destinations	
	Estimate	s.e.	Estimate	s.e.
Current parity (ref.: parity=0)				
Parity=1	-0.0892	(0.0690)	-0.2091 *	(0.1069)
Parity=2	-0.0567	(0.0892)	-0.0218	(0.1526)
Parity>2	0.0774	(0.1443)	0.1800	(0.2735)
Current age of the woman (duration spline)				
Slope age 15-17	0.0875 **	(0.0392)	0.0749	(0.0462)
Slope age 17-30	0.0041 ***	(0.0007)	-0.0011	(0.0010)
Slope age 30-40	-0.0046 ***	(0.0009)	0.0013	(0.0015)
Slope age >40	-0.0108 ***	(0.0029)	-0.0124 **	(0.0055)
Having school aged children (ref.: no)				
Having school aged children	-0.1556 **	(0.0742)	-0.3234 **	(0.1462)
Educational level (ref.: low)				
Medium level	-0.4214 ***	(0.0684)	-0.4815 ***	(0.0958)
High level	-1.7403 ***	(0.1443)	-1.4920 ***	(0.1975)
Provenience of immigration (ref.: non immigrated)				
Turin province	0.1766 **	(0.0784)	-0.1936	(0.1356)
North-Centre Italy	0.0332	(0.0725)	0.3366 ***	(0.1100)
South Italy	-0.1891 ***	(0.0600)	-0.1764 *	(0.0902)
Foreign countries	0.2715 *	(0.1596)	-0.3137	(0.2947)
Variance of the heterogeneity component				
Sigma-out-migration	0.7930 ***	(0.1332)	0.8693 ***	(0.3155)
Ln-L	-23902.3		-9501.8	

Asymptotic standard errors in parentheses; significance: *=10%; **=5%; ***=1%.

Guest, 1985). A low propensity to move is also associated with very young women, but this can be the result of the particular selection we applied. Since we selected only married women, when we are considering young women, we are also taking into account early marriages, and therefore scarce economic resources may have been the cause which hampered their mobility. Grundy and Fox (1985) found similar results by analysing the English and Welsh population around 1971.

The idea that economic resources can be very important in an urban context is moreover consistent with the effect of educational attainment: the higher the educational level, the lower the probability to out-migrate. People with a high educational attainment have higher chances to stay (or at least find a better location in the city that is affordable), and

may be more oriented to the 'urban culture', while others may be forced to move outside the city to find relatively cheaper accommodation. Note that this finding is only apparently inconsistent with Occelli's results (1993), emphasising that people with high resources showed the higher propensity to relocate: in our case, we are analysing out-flows from the core centre of Turin, while she was dealing with relocations in general. It may be that people with higher resources find a better location inside the Turin municipality, having a still lower propensity to leave the centre. Moreover, we have to take into account that the women we selected spent at least the entire period between age 15 and marriage in the Turin municipality. Therefore, we can suppose they had high incentives to try to stay in the city (due to social capital investment, see *i.e.* Astone *et al.*, 1999, and ties with the current location).

Finally, past residential history proves to be important. In comparison to non-in-migrants, in-migrants from North-Central Italy indicate a higher propensity to leaving the Turin municipality, while originating from the South hampers migration. The latter result shows that those who come from the South have higher incentives to stay longer. A possible explanation is that difficult life conditions in the place of origin caused the in-migration of the family, and returning (or moving again) would mean returning to an uncertain situation. Moreover, Southern in-migrants have lower incentives to move to the Northern country side, where they have no family ties, and a return to place of origin would mean affording a 'longest-long' distance move. Otherwise, we can also assume that the consistent flows that took place in the 1950s and 1960s from the Southern part of Italy towards Turin set up something like a 'Southern community', which women leave less often. This latter interpretation is supported by the fact that coming from the South hampers out-migration to every destination, even to Turin provinces. On the contrary, belonging to the Turin province significantly facilitates returns, and coming from the North or the Centre enhances a long-distance move. Again, different origins may be associated to different aims of migration: while in-migrants from the North-Centre may consider the move as temporary, the origin still having an attraction force, in-migrants from the South may consider their move as necessary and permanent.

When, in the analysis, we include the heterogeneity term, the model improves in a statistical sense, although the effect of the covariates does not change. This does not help us in assessing a possible meaning of unobserved components affecting out-migration process, but a general idea of attachment to the city or the perception of the quality of life can be applied.

3. Models for Fertility and Out-migration

Table 4 shows all parameters obtained in the model when we consider that some unobserved factor may impact on fertility and migration, and that heterogeneity in the propensity to leaving the city may be correlated with the propensity to having children in the Turin municipality.

Unobserved factors seem to be only slightly negatively correlated, but the correlation coefficient is not significant. The general idea is, therefore, that factors which are

Table 17. Results for the model with correlated unobserved heterogeneity terms

		Estimate		s.e.
Fertility				
Current parity (ref.: parity=1)				
Parity=2		-0.1153		(0.2254)
Parity=3		-0.2088		(0.3984)
Age at marriage				
Slope age 15-23		-0.0161	***	(0.0011)
Slope age 23-26		0.0028	*	(0.0015)
Slope age >26		-0.0043	***	(0.0008)
Age at previous birth				
Age at 1st birth		-0.0043	***	(0.0005)
Age at 2nd birth		-0.0085	***	(0.0010)
Length of previous interval 0.0010				
Protogenesic	<12 m	0.0622	***	(0.0149)
	>12 m	-0.0073	***	(0.0016)
Intergenesic	Slope	-0.0166	***	(0.0028)
Being immigrated (ref.: not immigrant)				
Immigrant, parity=0		0.2985	***	(0.0365)
Immigrant, parity=1		0.1998	***	(0.0468)
Immigrant, parity=2		0.1040		(0.1119)
Immigrant, parity>2		-0.1914		(0.3283)
Twins as last parity (ref.: no twins)				
Twins=yes		-0.2774		(0.2904)
Educational level (ref.: low)				
0 child	Medium level	-0.3028	***	(0.0548)
child	High level	-0.3210	***	(0.0774)
1 child	Medium level	-0.3182	***	(0.0589)
child	High level	0.3525	***	(0.0961)
2 childr.	Medium level	-0.1080		(0.1307)
childr.	High level	0.4893	**	(0.2262)
>2 Childr.	Medium level	-0.3665		(0.2919)
Childr.	High level	-0.7296		(0.6490)

	Estimate		s.e.
Migration			
Current parity (ref.: parity=0)			
Parity=1	-0.0641		(0.0751)
Parity=2	0.0665		(0.1276)
Parity>2	0.2836		(0.2008)
Current age of the woman			
Slope age 15-17	0.0819	***	(0.0298)
Slope age 17-30	0.0026	***	(0.0006)
Slope age 30-40	-0.0029	***	(0.0008)
Slope age >40	-0.0106	***	(0.0026)
Having school aged children (ref.: no)			
School aged children	-0.1782	***	(0.0666)
Educational level (ref.: low)			
Medium level	-0.4419	***	(0.0580)
High level	-1.7063	***	(0.1205)
Provenience of immigration (ref.: non imm.)			
Turin province	0.0757		(0.0699)
North-Centre Italy	0.1196	*	(0.0641)
South Italy	-0.1922	***	(0.0512)
Foreign country	0.1237		(0.1402)
Heterogeneity component			
Variances and covariance			
Variance for fertility	0.4761	***	(0.0581)
Variance out-migration	0.7408	***	(0.1056)
Correlation	-0.1868		(0.1581)
Ln-L	-97456.5		

Asymptotic standard errors in parentheses; significance: *=10%; **=5%; ***=1%.

positively correlated almost compensate the ones negatively correlated, and the net effect is only slightly negative. There is, therefore, only partial support for the hypothesis that the net effect predicts that a woman who shows a higher propensity than another

one to have children in Turin, will also have a greater desire to stay in Turin's municipality and, conversely, who desires more to leave the centre core also has an higher propensity to have fewer children. A possible interpretation of this result is that unobserved components can in part be an expression of how people perceive the quality of life in the Turin municipality (or in a specific neighbourhood) in each dimension of life. As Speare (1974) stated, residential satisfaction can have an effect on mobility, also when background variables are taken into account (such as duration of residence, age of the head of the household, location of the house – city or suburbs, being an owner or a renter, and so on). Following this interpretation, the better you feel in Turin, the more you want to have children there, and the less you desire to move. At the same time, Grundy's (1986) theory that negative housing conditions in the city depress fertility seems to be partially confirmed.

If we examine the effect on the other coefficients, we can appreciate that the only interesting change is on the parity coefficient in the migration equation. While before a significantly lower probability to out-migrate was associated to parity one, now there are no longer significant differences with having no children, and the apparent trend (the more children, the higher the probability of moving) still remains. Therefore, controlling for correlation across unobserved factors, having children does not seem to hamper migration.

4. Conclusions

In the present Chapter we analysed urban fertility in the Turin municipality, paying particular attention to the possible relation between fertility and out-migration choices. In trying to better understand interrelations between family life cycle events and out-migration, we selected people who were resident in the city at least since the age of 15, studying their behaviour after marriage. This particular selection considers people who chose to stay in the city at least until marriage.

In this context, fertility choices show some commonality with other contexts (for instance, as in the Italian case in general, the longer the waiting time between one birth and the next one, the lower the probability of having an additional child; or the younger the woman at the time of previous birth, the lower the chance of having another child) but also seem to be particularly conditioned by the educational level of the woman, which determines the resources for facing new births more than the rising opportunity costs of children (Becker, 1981c). Indeed, while for the first parity the lower the educational level, the higher the probability of having a child, a U-shaped effect emerges for transition to parity two and parity three. In other words, while low educated women show a higher inclination to having the first child, it seems that the most favourable situation for those who intend having two or more children is having a high educational level.

The same covariate is then important also for out-migration, reinforcing the idea that staying in and therefore having children in the Turin municipality is a matter of possibility.

The strong link between life cycle events and out-migration choices emerges considering both marriage itself and parity progression. Indeed, the greatest part of out-migrations happens in the first months after marriage, and this may be associated to the need to leave the centre core of the urban environment when deciding to marry. Then, parity seems to have an additional effect on the choice of moving, leading people with more than two children to consider the decision to move from the city more than people with just one child. When the number of children is high, the pull factor associated to parity (creating ties with the current location; Long, 1972) is compensated by its push factor (Grundy, 1986; Baizan, 2002).

If we now consider the behaviour of in-migrants (who have often been held to raise fertility levels in such situation), their fertility model is proved to be important, at least for first parities. The supported hypothesis is one of *adaptation* (Goldstein and Goldstein, 1981; Bean and Swicegood, 1985) which states that in-migrants behave differently from the host society until adaptation to the host urban society occurs.

Including the unobserved component in both processes allowed estimating unbiased coefficients (Lillard, 1993). Unobserved factors which simultaneously favour out-migration and fertility almost compensate the unobserved factors which facilitate one process, but hamper the other. The net effect of these components is only slightly negative, *i.e.* the correlation across unobserved factors is negative, but not significant. The net effect supports the idea that out-migration may be perceived as a possible solution to fertility plans which cannot be completely fulfilled in the city. This is in line with findings, suggesting that people may adjust the timing of events in the family life cycle in accordance with the availability of appropriate housing. Murphy and Sullivan (1985), for instance, discussed the connection between home-ownership and family stages in Britain. Mulder and Wagner (2001) focused their attention on the Netherlands and West Germany. A growing research theme concerns the connection between family formation and housing, and this paper places itself in this area.

Our research has a number of limitations. First, we can only consider fertility behaviour in Turin, and infer future behaviour (after migration occurs), only analysing the correlation through the unobserved components. Second, some important information could not be used, such as information relating to the working career. Finally, we focused on the migration behaviour of married people, but it would be very interesting to include unmarried individuals in the analysis. Unfortunately we do not have any information about family life cycle stages after a move from Turin, and we could not control migrations that happened because of marriage when the residential change anticipates family formation events, and this led us to only select married people.

6. Summary and Conclusion

The present work has dealt with both methodological aspects and empirical issues. Attention was focused on the topic of lowest-low fertility in the urban context of the Turin municipality, using an innovative source of information, the Turin Longitudinal Study (TLS), which covers every individual resident in Turin municipality for at least a short period of time from 1971 to 2000.

This data allows us to reconstruct the demographic evolution of the Turin municipality over time (at least since 1971) and to underline many of its specificities (see Chapter 3). Turin's municipality is indeed an important urban centre, which represented a pole of attraction for an incessant flow of in-migrants. Migratory components have been in the past (and are still nowadays) the major factors of replacement of the population, exceeding natural components, and this has many consequences on other demographic phenomena.

Analyses of demographic phenomena emphasised interesting elements. First, over time many changes occurred, and fertility behaviour of resident people at the present is extremely different from the past (concerning both intensity of the phenomenon and its time scheduling). This trend regards all the subpopulation taken into account (in terms of provenience of in-migration, referring to various fertility models), and delays in reproduction (as well as in marriages) and even reduction in fertility levels are generalized phenomena. Nevertheless, it is still possible to appreciate differences in fertility behaviour among different groups of in-migrants. This has to be taken into account in analysing demographic trends.

Second, analysis of out-migration emphasised that the favourite destination of a move changed over time: while in the past who moved preferred another city, nowadays he/she chooses to live in the Turin province. This emerging behaviour may be linked to the problem of finding a suitable (or cheap) house in the core of the urban area, or to the fact that being an owner is the ideal situation for many families and it is more difficult to achieve this in Turin's municipality than elsewhere. Therefore, also out-migration may be related to fertility behaviour.

These considerations suggested interdependency between processes under study, which can be analysed using event history techniques (to have a clue on these particular tools, see Appendix B) and motivated two fields of deeper research: the first concerning fertility changes that occurred over time, and the second focusing on interdependency between fertility and migration (both in- and out-) choices.

In Chapter 4 we therefore focused our attention on fertility changes. To emphasise connections between education and labour force participation and fertility in Turin's municipality, we considered transition from first to second birth, since this transition is a key point for understanding the fertility decline and there is a need to concentrate on a single stage of fertility history to allow us to use census information about educational

attainment and employment status. We compared the situation around 1971, 1981 and 1991. In doing so, we also considered the origin of in-migration and other characteristics concerning the past of fertility history.

Empirical evidence emphasised elements which are common to other contexts (for example the fact that the older the women and the longer the waiting interval between marriage and the first child, the lower the probability of progressing to second parity), and others specific to the urban context, first of all the role of origin of in-migration.

In this respect, coming from the South and Islands raises the probability of having a second child for 1971 and 1981 periods, but this covariate is no longer significant in 1991. Having immigrated from a foreign country shifts from having a negative to a positive effect on fertility, although the associated coefficient is never significant. These trends reflect, on the one hand, the high assimilation that occurred over time between in-migrant and autochthones women, mainly due to the quick reduction of fertility of in-migrants from the South of Italy. On the other hand the analysis emphasises the increasing importance of the groups of foreigners, which in the last decade seem to show a relatively high fertility.

Changes that occurred in fertility behaviour in the Turin municipality are then associated to social changes over time.

For instance, while in both 1971 and 1981 there were no differences in fertility behaviour between low and high educated women, this was not true in 1991: highly educated women show higher probability of having a second child. In fact this seems to reflect an analogous characteristic of the husband, since when we insert information concerning male educational level, female differences disappear.

A somehow surprising result concerns the occupational career: for a woman, being a housewife already between marriage and the first birth acquires a new meaning over time. While for 1971 we do not find any significant difference with other categories, in 1981 it is equivalent to being employed or studying. Besides, nowadays being a housewife constitutes the worst condition for having a second child, as well as being unemployed. In the generalised reduction of propensity to progressing to parity 2, the housewives seem then to reduce their will to having another baby more than employed women, and if we keep other characteristics constant (for example the age of the woman, her previous fertility history, …) being an housewife seems to hamper fertility.

Moreover, the position of the husband is also important, as in 1991 having a husband belonging to the working class is associated to a lower probability of parity progression.

All these different elements suggest that the economic condition is acquiring greater importance over time and fertility choices deeply depend on it. This implies a new scenario for fertility, since female participation in the labour market does not figure as an individual choice but as a need for realising fertility plans. As a result, the critical variable in studies of work-family conflict may no longer be work participation/non participation, but the organisation of work time. Flexible time schedules and the availability of childcare may reduce contrasts between these distinct roles, and allow a great possibility of choosing to have children or not.

To better understand urban fertility in the Turin municipality, taking simultaneous account of both the heterogeneous composition of the population, constituted by autochthon and in-migrants groups, and the strong sub-urbanization and de-urbanization processes which took place over time, in Chapter 5 we analysed a specific cohort (born in 1955-1956), following fertility and migration choices.

Indeed, both in- and out- migrations may be related to fertility behaviours. On the one hand in-migrants stemming from different areas refer to different fertility models. Once in Turin municipality, fertility models coexist and may even influence one another. On the other hand, part of the strong out-migration process is related to the relatively high costs of living expenses, combined with income constraints in cities, as compared to these same aspects in rural areas. Finding a suitable and cheap house may become a problem, and more important when the couple decides to have children. Thus, since the needs for the dwelling changes with both the current family composition and fertility plans, even out-migration may be connected with fertility choices.

In trying to better understand interrelations between family life cycle events and out-migration, we selected people who were resident in the city since at least the age of 15, studying their behaviour after marriage. This particular selection considers people who chose to stay in the city at least until marriage.

As emphasised in Chapter 4, analyses of this Chapter show that in the urban context, fertility choices show some commonality with other contexts. For instance, as in the Italian case in general, the longer the time between one birth to the next, the lower the probability of having an additional child; or the younger the woman at time of previous birth, the lower the chance of having another child. Fertility choices also seem to be particularly conditioned by the educational level of the woman, which determines the resources for facing new births more than the rising opportunity costs of children (see Becker, 1981c). Indeed, while for the first parity the lower the educational level, the higher the probability of having a child, a J-shaped effect emerges for transition to parity two and parity three. In other words, while low educated women show a higher probability of having the first child, it seems that the most favourable situation for whom intend having two or more children is having a high educational level.

The same factor is then important also for out-migration: those who have a higher educational level also show a lower propensity to move out. This reinforces the idea that staying in and therefore having children in the Turin municipality is a matter of resources. The strong link between life cycle events and out-migration choices emerges when considering both marriage itself and parity progression. Indeed, the greatest part of out-migrations happens in the first months after marriage, and this may be associated to the need to leave the centre core of the urban environment when deciding to marry. Then, parity seems to have an additional effect on the choice of moving, leading people with more than two children to consider the decision to move from the city more than people with just one child. Indeed, when the number of children increases, the need of finding a suitable dwelling becomes stronger, and those who do not have enough resources to satisfy it in the city have to move out.

If we now consider the behaviour of in-migrants (who have often been responsible for raising fertility levels in such situation), their fertility model is proved to be important, at least for first parities. The supported hypothesis is one of *adaptation* (Goldstein and Goldstein, 1981; Bean and Swicegood, 1985) which states that in-migrants behave differently from the host society until adaptation to the host urban society occurs.

Finally, the analysis focusing on the interrelation between fertility and out-migration, confirms the idea that out-migration may be perceived as a possible solution to fertility plans which cannot be completely fulfilled in the city. This is in line with findings suggesting that people may adjust the timing of events in the family life course in accordance with the availability of appropriate housing.

A. FERTILITY RATES BY ORIGIN OF IN-MIGRATION

Figure 27. Fertility rates of in-migrant women from Turin province considering only residence period and the whole reproductive stage

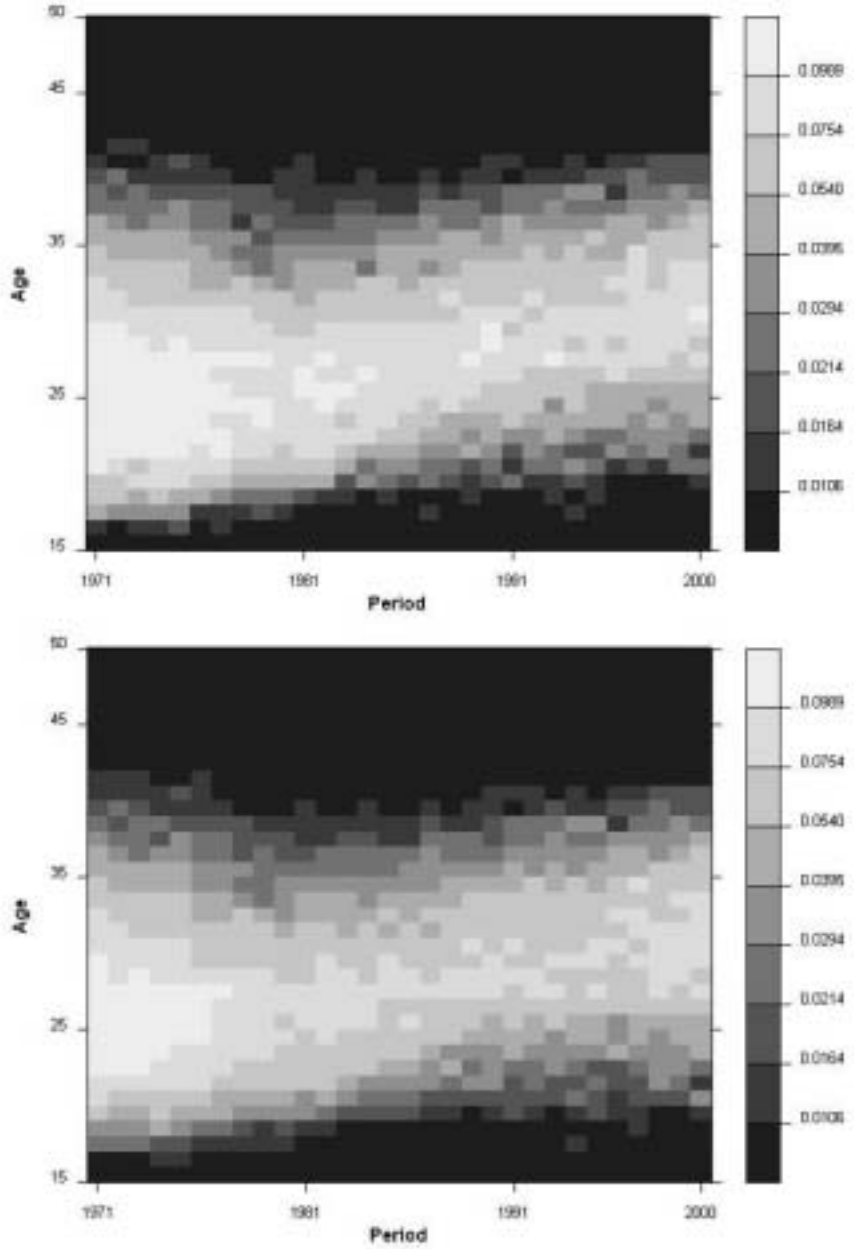


Figure 28. Fertility rates of in-migrant women from Piedmont (excluding Turin province) considering only residence period and the whole reproductive stage

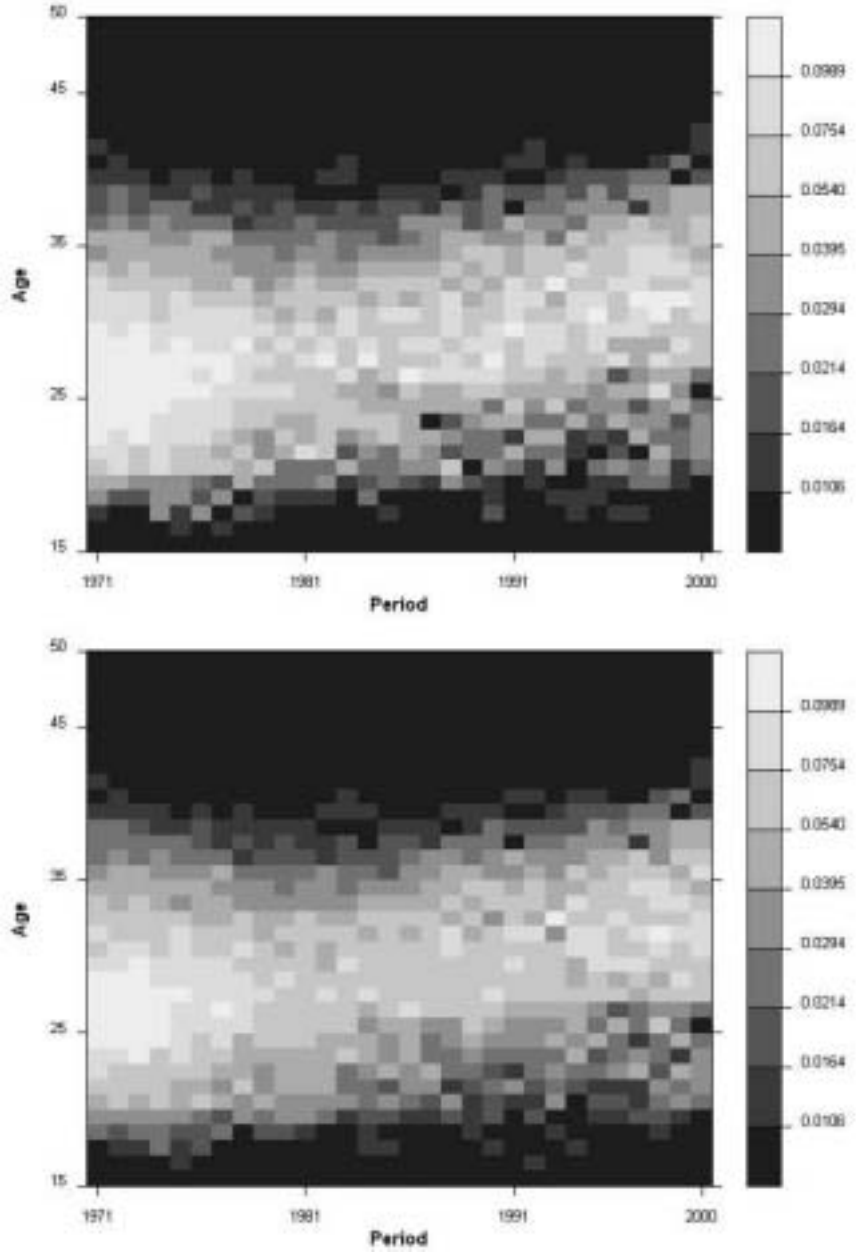


Figure 29. Fertility rates of in-migrant women from North-West Italy (excluding Piedmont) considering only residence period and the whole reproductive stage

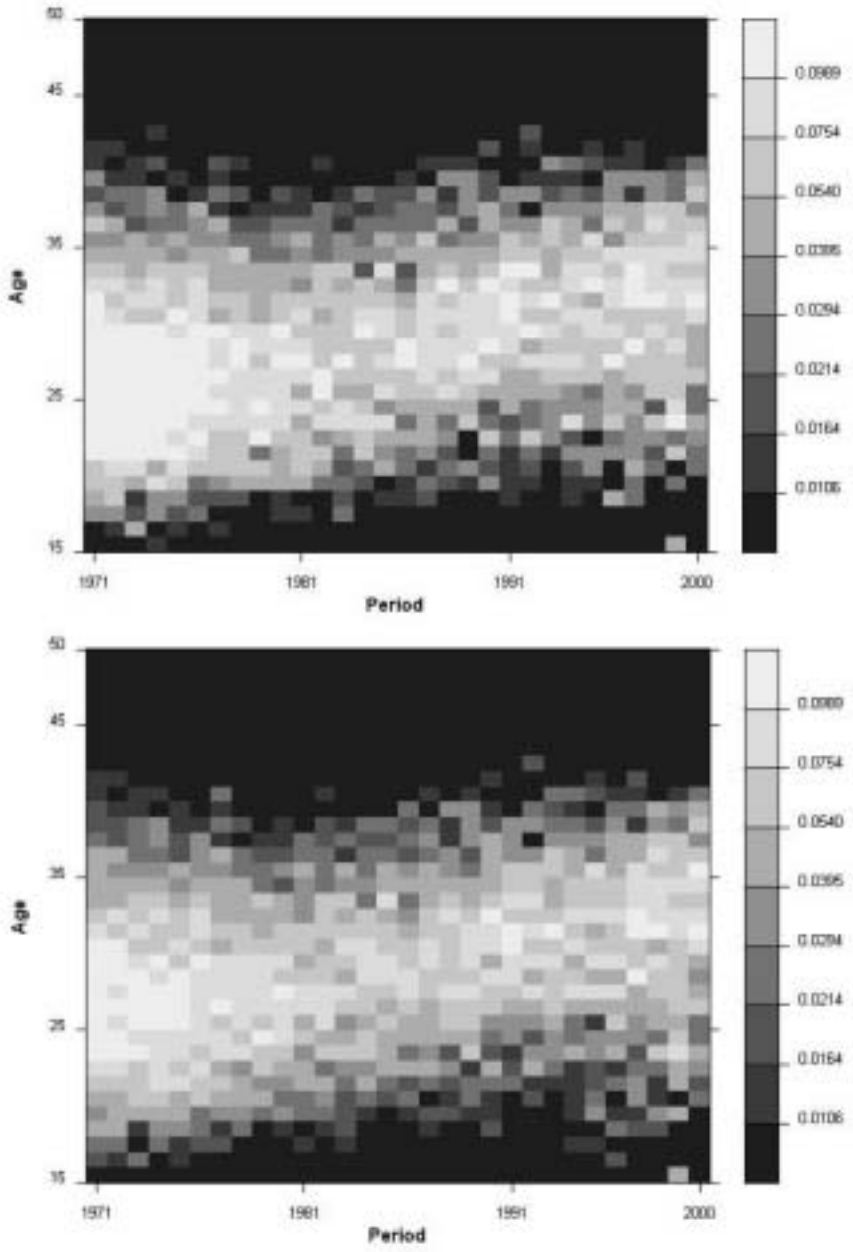


Figure 30. Fertility rates of in-migrant women from North-East Italy considering only residence period and the whole reproductive stage

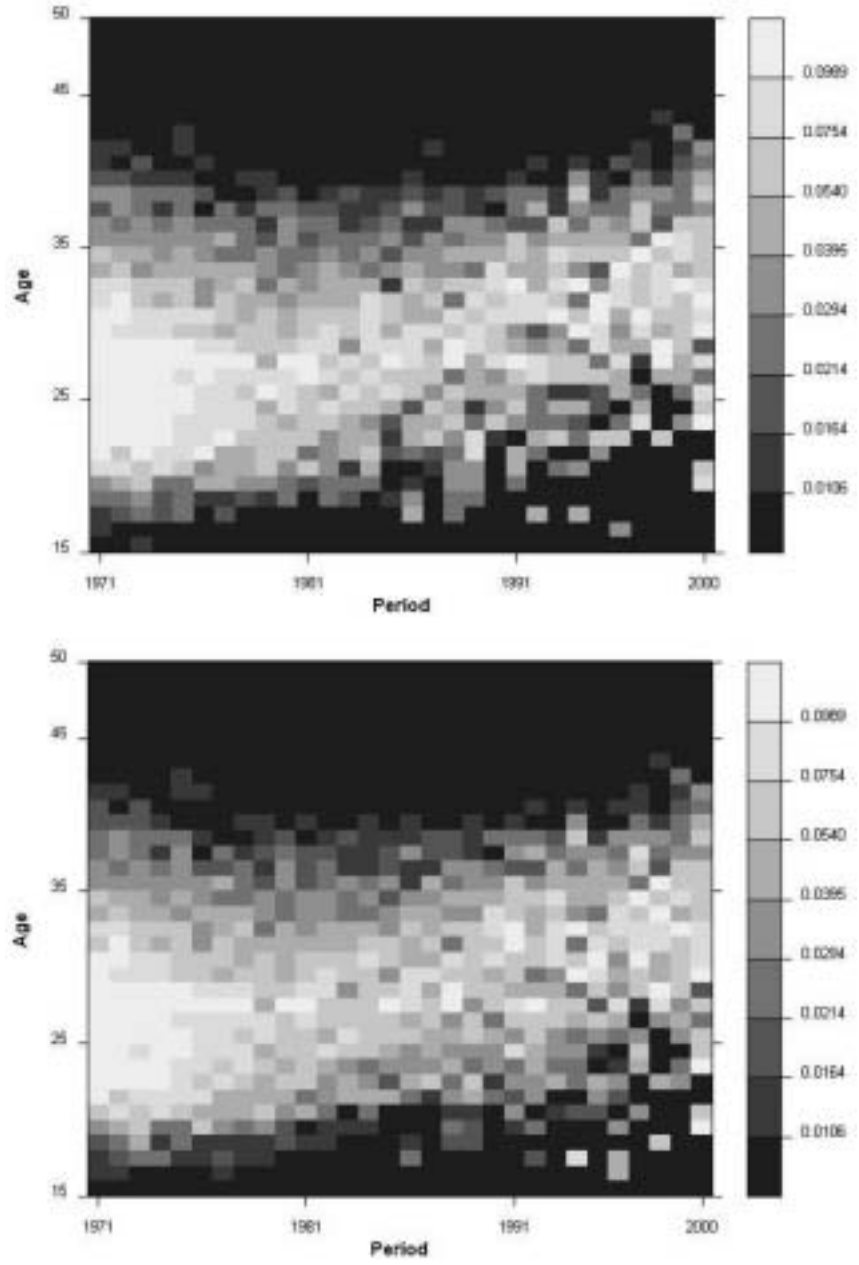


Figure 31. Fertility rates of in-migrant women from Centre Italy considering only residence period and the whole reproductive stage

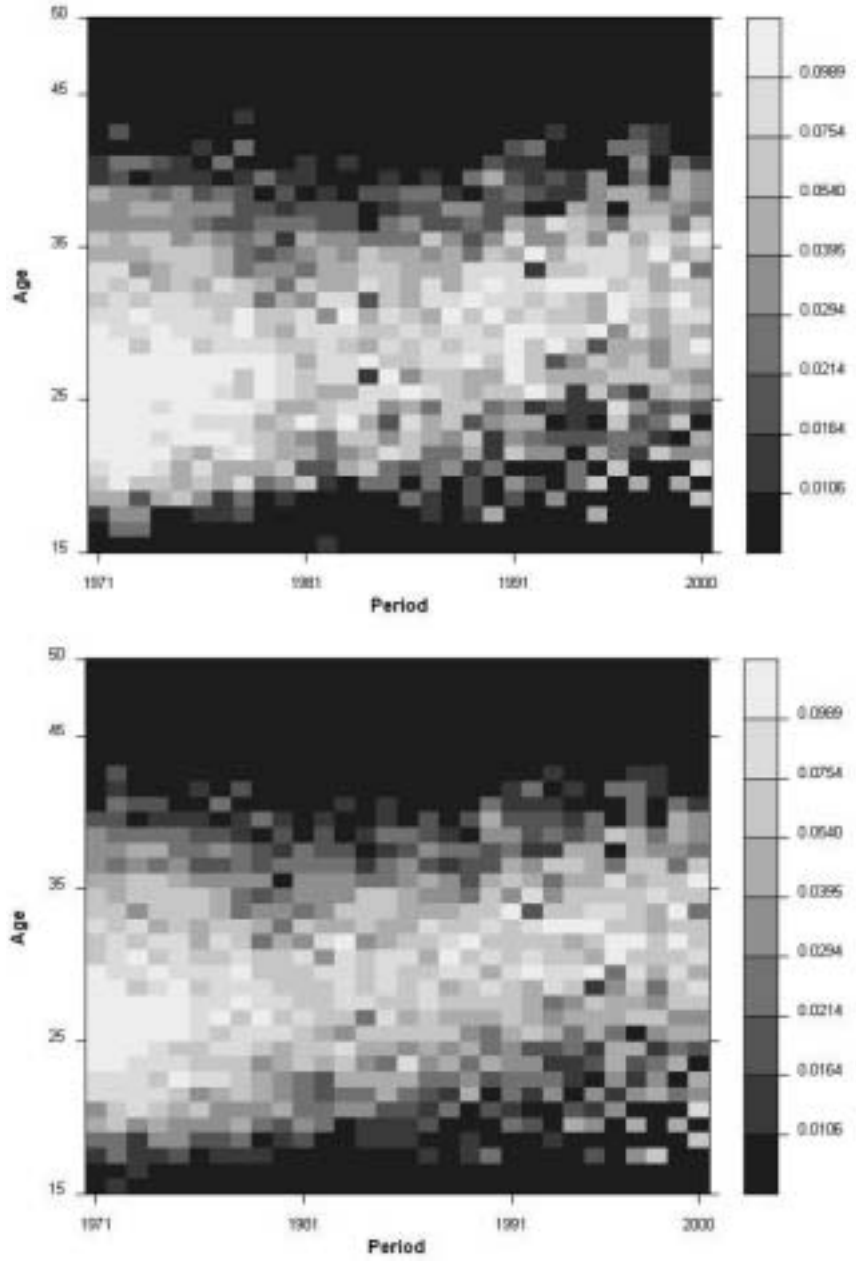


Figure 32. Fertility rates of in-migrant women from South Italy considering only residence period and the whole reproductive stage

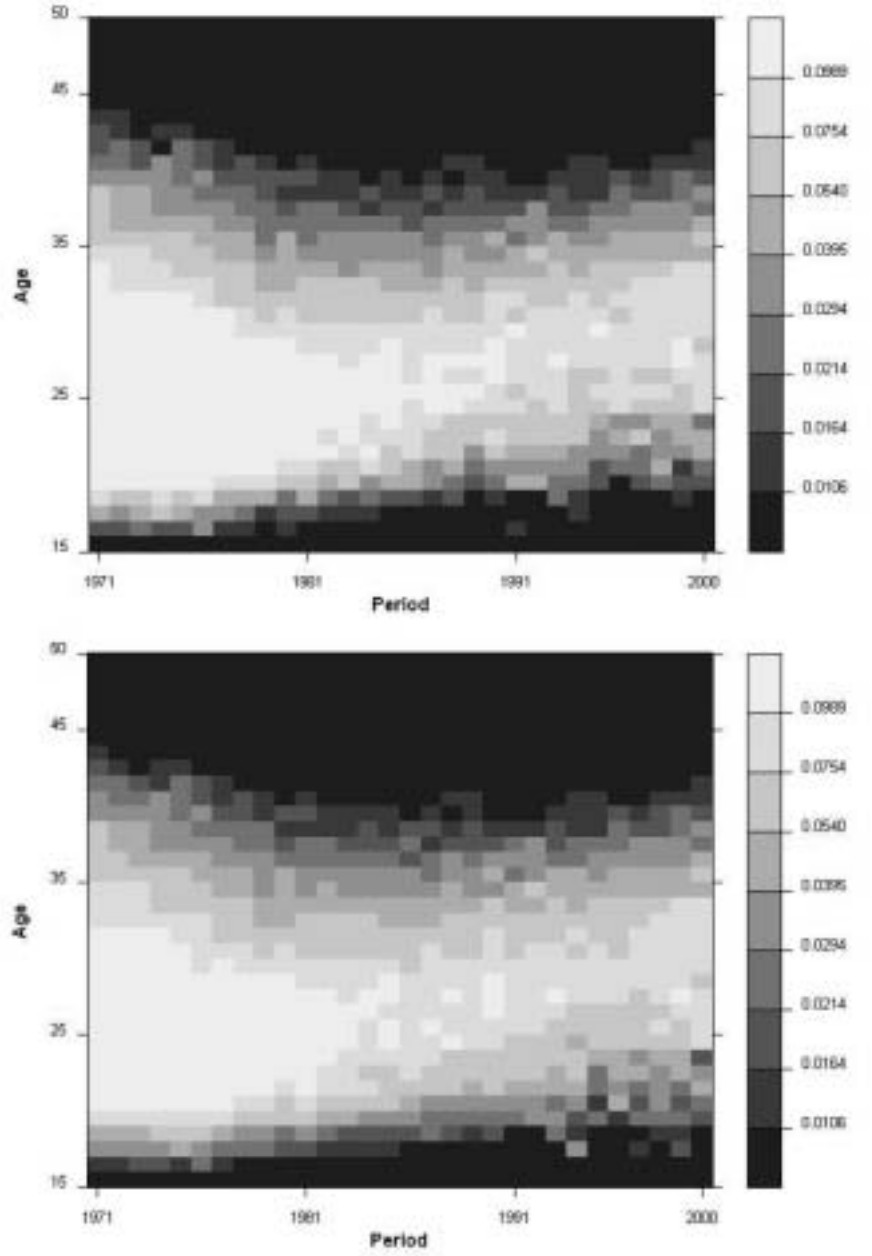


Figure 33. Fertility rates of in-migrant women from the islands considering only residence period and the whole reproductive stage

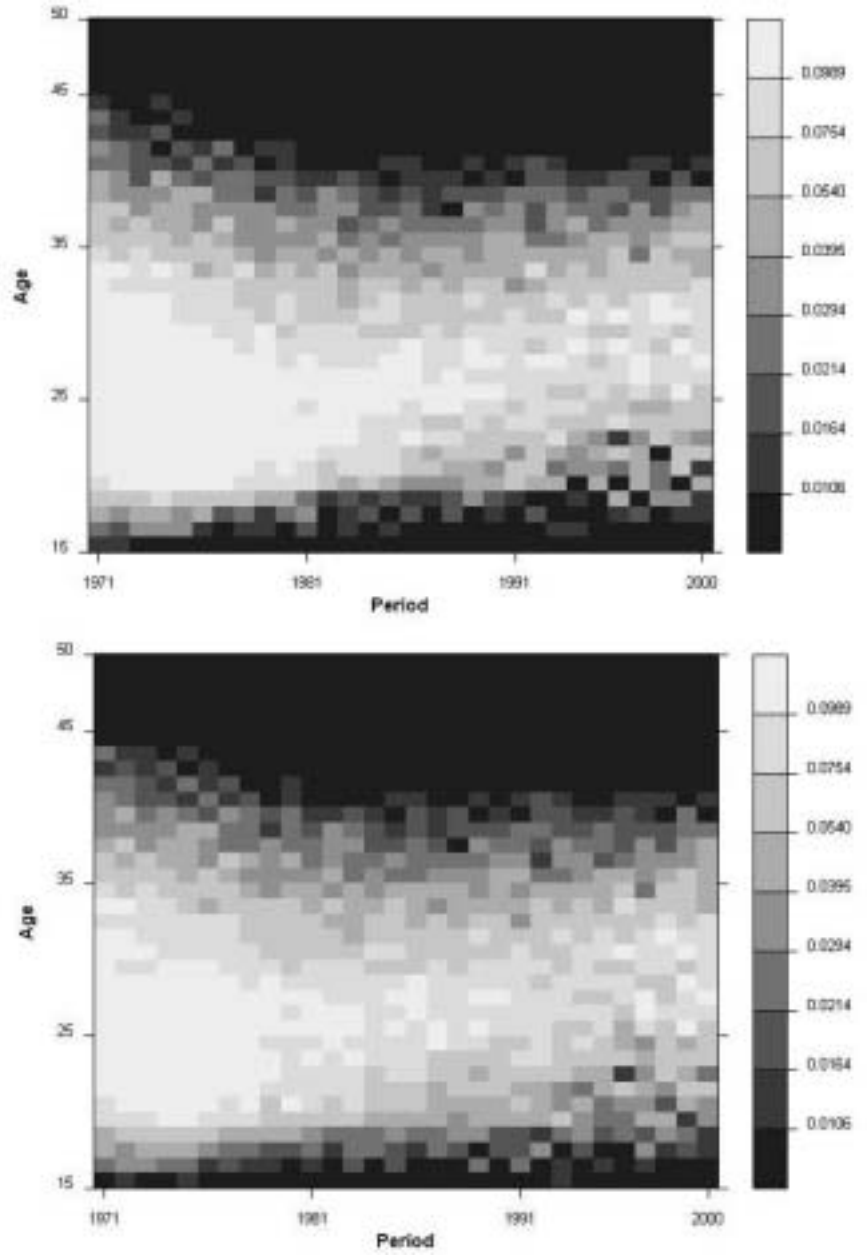


Figure 34. Fertility rates of in-migrant women from a foreign country considering only residence period and the whole reproductive stage

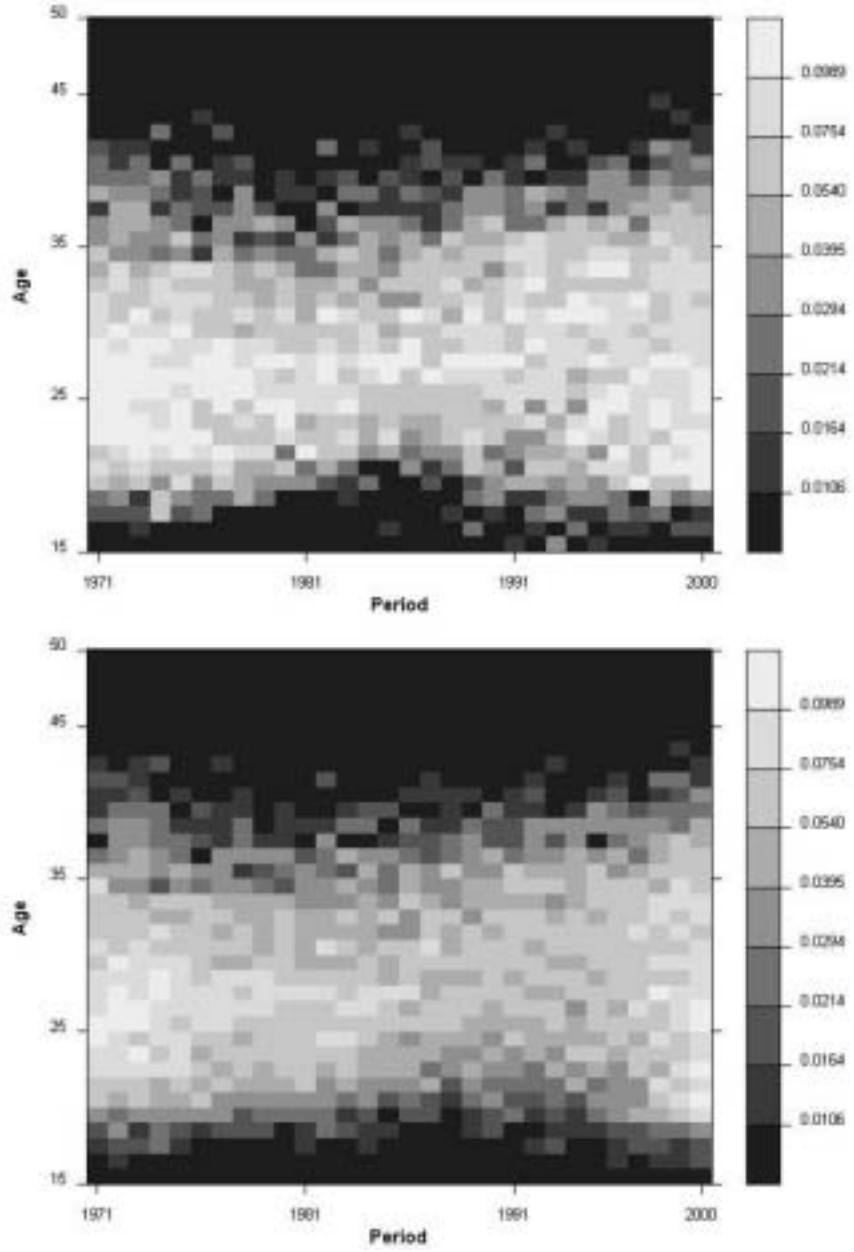
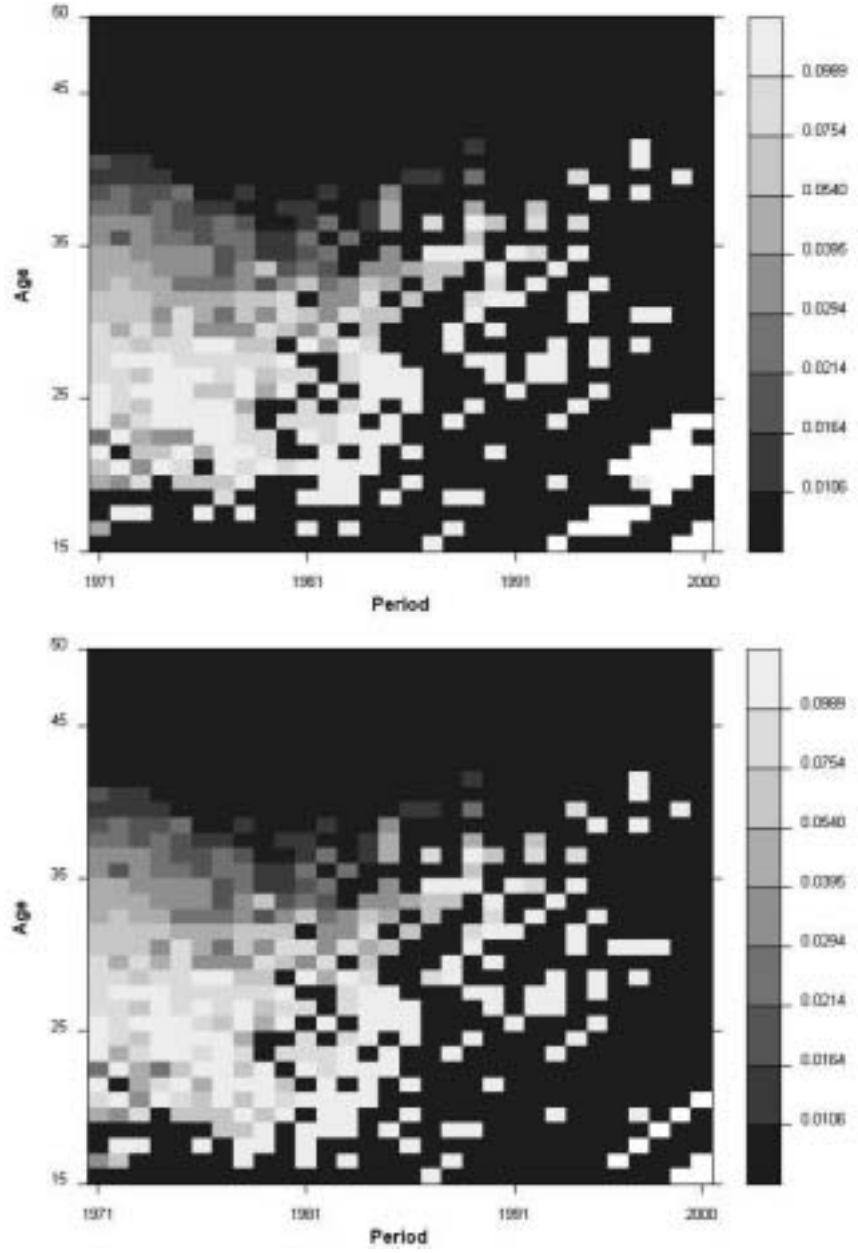


Figure 35. Fertility rates of in-migrant women from an unknown area considering only residence period and the whole reproductive stage



B. EVENT HISTORY ANALYSIS: METHODS FOR AN EXPLANATORY APPROACH

In Chapter 1 our attention was in part focused on the kind of approach we use to analyse social changes. Following Coleman (1994) and Hedström and Swedberg (1996), the need to understand society from the inside -and so from the level of individuals- emerged clearly. The shift to a life course approach (Giele and Elder, 1998a) was the second step in this reasoning, and events and trajectories became our main interest.

We should however be more precise in what we mean by *explanation*. How can we 'explain' using methodological tools as event history analysis?

Following Hedström and Swedberg (1996), explaining means 'finding the causes', or in other words understanding what mechanisms link some specific input to some specific output: we may even represent it graphically, as shown in Figure 36.

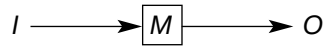
The model from Coleman (1994) then acquires an useful meaning if and only if we explain '*how* macro states at one point in time influence the behaviour of individual actors, and *how* these actions generate new macro states at a later time' (Hedström and Swedberg, 1996). The authors underline that a proper explanation needs to avoid what is called a 'black box', which occurs whenever the link between *explanans* and *explanandum* is assumed to be unimportant or is not directly explicated.

This problem also exists in life cycle studies as suggested by Willekens (1999) 'events and structures can be observed quite easily, but the "underlying" processes that generate the events and structures are often difficult to detect. To interpret or explain events, the underlying, causal process must be identified (uncovered) and understood.'

What a causal modelling approach can provide, in terms of Hedström and Swedberg's (1996) representation, is exactly to show the existence of some link between *I* and *O*, but no explanation of *M*. However paraphrasing Boudon (1974), we must go beyond the statistical relationships to explore the generative mechanism responsible for it. 'In other words, the argument itself must be not statistical but substantive: it must be concerned not with relations among variables but with the ways in which the data constituting the *explanandum* is actually brought into being.' We therefore need a further effort to give statistical relations a theoretical meaning, and social and economic theories can help in providing this explanation.

The plan of this Chapter is as follows. In Section 1 we briefly sketch different meanings of causation, and in Section 2 we combine theoretical and methodological arguments, as two aspects of the same issue. We present current alternative sociological theories, underlining the main assumptions and implications. The discussion concentrates attention on economic, structural and ideational theories, as they represent different points of view in approaching the problem of explanation of social changes.

Figure 36. The input, the output and the black box



Source: Hedström and Swedberg, 1996

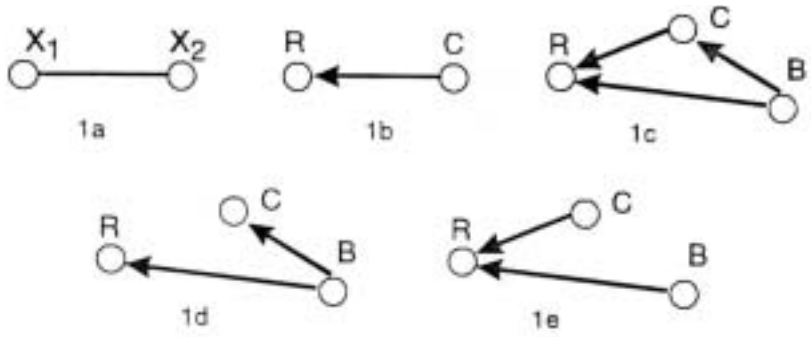
Section 3 considers different approaches of representation of event histories, as a useful tool for testing hypotheses deriving from sociological theories.
Finally, in Section 4 we focus our attention on the approach which explicitly includes the existence of unobserved heterogeneity and to the particular kind of models proposed by Lillard and colleagues (Lillard, 1993; Lillard and Waite, 1993; Lillard *et al.*, 1994; Panis *et al.*, 1996; Brien *et al.*, 1999; Upchurch *et al.*, 2002).

A. An Introduction to 'Causation'

In this introduction, we already mentioned that 'causation' may have different meanings. To clarify some ideas concerning this wide concept, we follow ideas presented in a review article by Cox and Wermuth (2001).
Cox and Wermuth (2001) see causality as 1) stable association, 2) an effect of intervention, or 3) explanation of one process.

1) If we are looking for a *stable association*, we first need to distinguish between statements about causation and association. In fact, while the latter focuses on the observation of how the values of one variable are associated with the values of another variable, the former tries to say something about how events are produced or conditioned by other events. In other words, causation is an asymmetric relation, while association is symmetric. 'That is, if *C* is associated with *R* then *R* is associated with *C*, but if *C* is a cause of *R* then *R* is not a cause for *C*' (Cox and Wermuth, 2001). A graphical representation of this is provided in Figure 37.

Figure 37. Association and causation



(a) Undirected edge between two variables X_1, X_2 *on an equal footing*
(b) Directed edge between explanatory variable C and response variable R
(c) General dependence of response R *on* B, C
(d) Special situation with R ⫫ C | B
(e) Special situation with B ⫫ C *corresponding in particular to randomization of* C

Source: Cox and Wermuth, 2001

The main issue in this view is to distinguish between causation and association. In their view, this can be done in two different ways: first observing that features referring to an earlier point in time can be explanatory to features referring to a later point in time; second using hypotheses deriving from theories or from previous studies.

2) Stronger evidence is required when we refer to causality as the *effect of an intervention*: in the latter case, we should assure that the effect really depends on a specific cause.

To clarify this idea, assume that there are just two causes or levels of treatment: the treatment and the control. The role of the response variable *Y* is to measure the effect of the cause, and to assess this we should measure the response under the treatment and the response under the control. We do not dispose of the counterfactual observation, *i.e.* of the observation of what would happen to the response if each unit exposed to the treatment had been exposed to the control instead, and vice-versa. The consequence, therefore, is that it is impossible to observe the real effect of the cause on the response. (Note anyway that this assessment does not deny the possibility of making causal inferences, because the impossible-to-observe causal effect on a specific unit is replaced by the possible-to-estimate average causal effect over a population of unit.) This issue is known in the literature as the *fundamental problem of causal inference* (Holland, 1986).

Randomisation to overcomes this problem in an experimental setting, since different unit belonging to the same subgroup are considered as equivalent, but in social research these conditions can not be fulfilled, and the problem is of major importance when we base our inferences on an observational study.

A possible solution consists therefore in relaxing the condition under which we speak of causal relation, as in Blossfeld and Rohwer (1995). In Blossfeld and Rohwer's view indeed a causal statement can be assessed when 'a change in variable X_t at time *t* is a cause of a change in variable Y_t at a later point in time, *t'*. It is not implied, of course, that X_t is the only cause that might affect Y_t. So we sometimes speak of *causal conditions* to stress that there might be, and normally is, a quite complex set of causes'.

To summarize it, we can write $\Delta X_t \rightarrow \Delta X_t$.

Then we may introduce indeterminacy, and the above condition may be written as $\Delta X_t \rightarrow \Delta P(\Delta Y_t)$.

In the expression above, causes, instead of being seen as necessitating their effects, might be regarded simply as raising the probability of their occurrence. We shift from a deterministic to a probabilistic view of causation. As pointed out by Goldthrope (2000), 'a probabilistic view of causation might be associated with the argument that the world itself is non-deterministic; but such a view could also be favoured simply on the grounds that, whether the world is deterministic or not, it is too complicated, and our knowledge of it too error-prone, to permit anything other than probabilistic accounts to be provided.'

Both these definitions emphasise the role of *time* as indispensable to asses any form of causality, because the cause must precede the effect in time. As underlined by Kelly and McGrath (1988), this time interval can be very short or very long, but not null nor infinite.

Moreover, time is important also because variations in the value of covariates may happen, getting close to the idea of counterfactual reasoning: time varying variables indeed allow switching on and off of the cause itself, so that the same unit is exposed and not exposed to the cause. In this manner the problem of absence of counterfactual observation still remains, because exposition and not exposition can not occur *at the same time*, but from Holland's view at least these variables assure that they are seen as causes.
As a consequence of this framework, it is possible to assess causality only when potential exposition of the units to causes is assured, that means that 'causes are only those things that could, in principle, be treatments in experiments. The qualification "in principle" is important because practical, ethical, and other considerations might make some experiments infeasible, that is, limit us to contemplating hypothetical experiments.' (*ibidem*).
This means also that attributes of units (such as sex for individuals) can not be proved to be a cause. For these time constant variables, indeed, we are not examining causation but only association. As Cox and Wermuth (2001) underline, structural variables, which are essentially defining intrinsic characteristics of individuals, should not be regarded as potentially causal. 'For example the gender of an individual is in most contexts an intrinsic characteristic. The question what would *R* have been for this woman had she been a man other characteristics being held fixed is in many, although not quite all, contexts meaningless.'

3) The latter notion of causality deals then with the idea of *explanation of a process*. In other words, this is causality for example as Boudon (1996) intended. 'In this context causality implies that there is some understanding, albeit provisional, of the process that leads from *C* to *R*. This understanding typically comes from theory, or often from knowledge at a hierarchical level lower than the data under immediate analysis.' (Cox and Wermuth, 2001).
The latter view can be combined with some others, for example in Blossfeld and Rohwer (1997): 'models per se will not allow us to prove causality [in the sense of explanation of a process]. The crucial point is however that causal statements [in statistical sense] need a theoretical argument specifying the particular mechanism of how a cause produces an effect or, more generally, in which way interdependent forces affect each other in a given setting over time.
As a result, the important task of event history modelling is not to demonstrate causal processes directly, but to establish relevant empirical evidence that can serve as a link in a chain of reasoning about causal mechanisms.'

Starting from this argument, both theoretical and methodological aspects are then important.

B. Theoretical Frameworks for Building Hypotheses

The need to move from description to explanation emerged clearly also in statistical demography and in demography in general (as stated by Dykstra and van Wissen,

1999a). Much research is now focused exactly on the mechanisms underlying observed behavioural patterns. In this shift of perspective, demographers turned to other disciplines (sociology, economics, anthropology, and social psychology), to borrow from them explanatory frameworks. This developed an interdisciplinary approach, in which insight from a variety of social scientific disciplines have been linked and integrated.

Sociology in this respect has an important role, also because alternative and competing theoretical models are available (see for example Duke, 1967). Here, we present some specific aspects of the *rational choice model*, of the *cognitive rational model* and of the *ideational approach*, finally providing a reason for combining all these different aspects together.

To begin this discussion let us start by Boudon's article towards explanations without black boxes (1996). In this article the *rational choice model* is firstly presented as the most appealing model for understanding social phenomena. Indeed, to reach what Boudon calls a 'final explanation' (that means an explanation without black boxes), individual decisions have to be understandable, and rationality provides the chance of understanding. The basic idea of the rational choice model consists in considering actions as guided by the maximisation of utility, that means that the alternative chosen is the one to which the maximum difference between benefits and costs is associated. Actions can then be the result of preferences in the space of feasible alternatives. Problems arise when one takes into account certain paradoxes, since the general model can not explain them.

The problem is indeed that (as assured by Boudon, 1998) the rational choice theory can not be applied to all research situations and to all problems for two reasons. First: the action is not always instrumental, *i.e.* individuals do not always decide to reach some aim; second: even when the action is instrumental, it can involve beliefs that normally are not explained by rational choice theory.

Towards the first assertion, actions can in fact be of different kinds: instrumental, instrumental with a cognitive dimension (the actor has the impression that through the action M it is easier to achieve a goal G, but the relation between M and G is not straightforward) or non instrumental at all (the action M is experienced just because M is coherent with the principle the actor endorses). Converting non instrumental actions to instrumental at a deeper level, under the idea that beliefs are the product of self interest, is still unsatisfactory.

Moreover, individuals are embedded in social and normative structures, and costs and benefits acquire different meanings in such different contexts. Although in a rational choice approach tastes and constraints are seen as important ingredients because they contribute to draw the utility function, they are rarely explicitly defined. But as Kelle and Lüdemann (1998) underline, if concrete constraints and their changes in time and space are left unspecified, the theoretical model is necessarily empty.

To solve both these issues, Boudon proposes to adopt the *cognitive rational model*, in which 'actions, decisions, and beliefs are meaningful to the actor in the sense that they are perceived by him as grounded on reasons. Even though he cannot identify these

reasons clearly, he has the intuitive impression that they are grounded on reasons.' (Boudon, 1996).

A slightly different approach is that of *structural theories*, in which the stress is on structural constraints that affect individual actions and facilitate or make the attainment of specific aims harder (Blossfeld and Prein, 1998b). Rationality is still an important assumption, but it is seen through structural individual's characteristics, in terms of different opportunities and costs. Variables are therefore the core point, and this generated the strongest criticism, assessing that following structural theories, variables instead of individuals are experiencing events. Indeed, whenever 'no effort is made to show how the statistical relations between variables derive from their "real causes", that is, the actions of individuals' (Goldthorpe, 2000), a gap in the explanation remains.

In fact structural theories provide an explanation of the phenomenon under study only if bridge assumptions explicitly indicate the relationship between macro-structures and variables of action theory (Esser, 1998). The latter 'determine how and which aspects of the situation occupy certain variables in the action theory. For example, if the premises of the action theory contain expectation and evaluations, the bridge hypothesis indicates for a given situation what and to what extent a typical actor evaluates positively or negatively, what they consider to be likely or unlikely, or to be risky or uncertain.' (Esser, 1998). The problem is in fact that the effect of the structural element can change over time, not because the action law has changed but just because the relationship between the macro-structures and the variables of the action theory was modified.

In both approaches presented above, tastes and preferences are not central points of attention, since they are recognised but not explicitly considered in economic theory and just deductible as attributes of particular characteristics in the structural theory. The general idea is in fact that values are important, and can orient behaviour, but since we can observe only actions (as indirect result of values), the former are not explicitly taken into account.

An approach which on the contrary stresses the importance of norms and values in directing behaviour of people is the *ideational approach*.

A useful definition of values can be derived from Rokeach (1969): 'Values have to do with modes of conduct and end-states of existence. More formally, to say that a person "has a value" is to say that he has an enduring belief that a particular mode of conduct or that a particular end-state of existence is personally and socially preferable to alternative modes of conduct or end-states of existence.'

This definition underlines that values are not situation dependent (this makes them different from attitudes), that values are constant in time (although this point is still discussed in the literature, see Lesthaeghe and Moors, 2000) and that they internalise criteria deriving both from the society and from an individual orientation (we can therefore recognise a multilevel structure).

The basic idea of this approach is that once basic needs (existential, such as sustenance and security) are satisfied, new needs emerge, and the role of values in life course decision acquire more and more importance. The new needs indeed can not be easily

described in terms of utility in the material sense, and therefore can not be easily understood in terms of pure economic reasoning (Lesthaeghe and Moors, 2000). Culture 'defines the area within which we can plausibly interpret individual behaviour as choice' (Pollak and Watkins, 1993), and thus delimits applicability of the rational actor model.

Previous arguments provide some reason for considering one approach instead of another, and simultaneously shed some light on what is still missing in each model. In the research field, there has certainly been an important shift from earlier crude economic models with unrealistic assumptions to more recent theories which include the idea of heterogeneous preferences, the effect of constraints, etc. (Blossfeld and Prein, 1998b). The strong duality between an intentionally acting person guided by instrumental rationality and a passive executor of social norms (or culture) therefor no longer exists, but both rationality and culture are seen as important in providing motivation for actions.

In addition, our aim is not to find one theory which can explain everything, but on the contrary to provide an explanation to something. As underlined by Pollak and Watkins (1993), cultural and economic approaches can be compatible, either when they are consistent or equivalent to each other, or when a cultural explanation attempts to specify the scope of economic rational choice explanations. Notice in fact that in principle the rational actor model include preferences, and since they can also be viewed as extremely individualistic, this is compatible with substantial heterogeneity of preferences and so with the ideational approach. Therefore in our conceptual models we can not avoid considering both structural elements, variables representing the social context and even cultural elements.

Moving a little bit further, we emphasise the fact that different approaches can also complement each other, 'when mechanisms specified in one partial theory activate, or are activated by, mechanisms considered in the other partial theory' (Lesthaeghe and Moors, 2000). For these reasons, the explanation we will provide for the phenomena under study will be derived from all possible approaches, without a clear definition of the threshold between one approach and the other.

C. Event History Analysis: a Methodological Tool for Testing Hypotheses

In the previous part of the Chapter, we briefly sketched different approaches that could be useful for providing a framework for the explanation of social phenomena. Through these approaches it is possible to derive which elements can be important for the explanation so as to include them in specific statistical models. Then, the results of models will again provide some feedback to theories.

Event history analysis is the statistical tool we will employ for testing hypotheses. Thus it is necessary to underline some specificity of event history analysis and assess the kind of questions these models can answer.

In Chapter 2, some characteristic of the life course approach has already been emphasised. The heterogeneity of the population has indeed to be taken into account, in terms of events experienced and different contexts. Time has then a fundamental role, since it incorporates different dimensions, such as the age, period and cohort. The other key elements are then events, since 'status changes in one life domain preclude, delay, enable or accelerate status changes in other life domains' (Dykstra and van Wissen, 1999a).

We will therefore first define different ideas of dependency across trajectories, then link dependencies to approaches in event history and finally decide which approach will be followed in this thesis. The structure of the presentation follows Huinink (2001), who analyses interdependencies with respect to union formation.

1. Interdependent Trajectories

Following the presentation by Huinink (2001) we first introduce some notations.

A life course can be described as a multivariate stochastic process, in which each dimension represents a distinct career (or in general sub process). Let us define the life course as a D dimensional process $L(t) = (L_1(t),\ldots,L_D(t))$, $t = 0, \ldots, \tau$. D represents the number of sub processes, while τ is the latest observed time.

Each sub process has a finite state space, $S(L_d) = \{s_1(L_D), \ldots, s_{j_d}(L_D)\}$, where J_d is the number of possible states for the sub process d.

We can then define the history of each sub-process and the history of the whole life course, as a sequence of episodes. The history of the d-th sub-process is identified by $H_t(L_d) = (E_i(L_d), s^i(L_d))$, $i = 1, \ldots, I_{dt}$, where each episode i is defined through the time at which it begun and it ended, $E_i(L_d) = [tb_{i,d}, te_{i,d}]$, and state occupied in the state space, $s^i(L_d) \in S(L_d)$; while the whole history is described by $H_t(L) = (H_t(L_1), \ldots, H_t(L_0))$ and refers to the state space $S(L) = \{S(L_1),\ldots,S(L_D)\}$.

The fact that sub processes can be interdependent is commonly accepted, being moreover the key feature of event history analysis. But what does interdependence mean?

In general local interdependence between L_i and L_j means that either L_i influence a state change for L_j, or vice versa. Both can also happen.

In the literature, several kinds of *local interdependence* between trajectories have been defined, since we can find dependence 1) on the status occupied by one sub process, 2) on a specific change in the status occupied, 3) on duration in this status or 4) on the risk of experiencing a status change. We will examine each in more detail.

1) We say that the sub process L_i is *status dependent* on the sub process L_j if the probability of an event on $L_i(t)$ depends on the status occupied in $L_j(t)$.

2) L_i is instead *event dependent* on the sub process L_j if the probability of an event on $L_i(t)$ depends on the occurrence of an event in the sub process $L_i(t')$, where $t'<t$. In other words a change of the sub process L_j from status j_1 to status j_2 at time t' can enhance or inhibit the occurrence of the event in L_i.

3) Sometimes is the duration in a state which has greater importance, so that the

occurrence of an event in L_i depends on the duration a status is occupied in L_j. As Huinink (2001) underlines, pure duration effects are almost impossible, while in general *duration dependence* occurs relatively to some particular state occupied in L_j.

This idea of duration dependence recalls an important point underlined by Blossfeld and Rohwer (1995) and considered again in Blossfeld and Mills (2001) concerning the fact that the effect can emerge in different ways after the cause, involving different temporal shapes of the unfolding effect. Therefore, they assess that to completely understand the causal relation between variables (in the sense expressed up to now), it has also to be taken into account that the causal relation itself may change over time.

4) The last kind of dependence we consider is the *rate dependence*, in which the trajectory L_i is said to be *rate dependent* on the trajectory L_j if the occurrence of one event in L_i at time t depends on the rate of the transition at time t between some defined state for the sub process L_j (Tuma and Hannan, 1984). The idea behind it is that the rate can be interpreted as an unmeasured propensity to experience this transition, which can be correlated with the probability of experiencing a transition on the dependent sub-process. If the two sub processes do not influence each other reciprocally, then the dependence is asymmetric, and we can treat the influencing variable as exogenous. In this case, one of the two trajectories seems to influence in a causal way the other.

Two kinds of time dependent covariates are exogenous by nature (Blossfeld and Mills, 2001). In the first group we find *defined time dependent covariates*, also called *deterministic time dependent covariates* by Willekens (1999), whose values can be determined in advance for all subjects under study. Two examples are age and the duration in some state (after defining the beginning of the exposure, the duration at risk is automatically defined). The second kind consists of *ancillary time dependent covariates*, which values are output of a stochastic process that is external to the process under study and therefore, by definition, are not influenced by the dependent process itself. As an example we can consider all macro characteristics of the society (unemployment rates, occupational structure, etc.).

The third type of time dependent covariate, which can not be considered exogenous by principle, consists of the *internal time dependent covariates*. Willekens (1999) refers to them as stochastic covariates generated by a stochastic mechanism internal to the process being studied. For these covariates we have often to deal with the fact they are endogenous, and including them in the analysis is very complicated.

What can happen is indeed that *reverse causation* is acting, that means that the dependent process itself has an influence on the covariate process. Or they may be some unobserved characteristics that influence both processes, and we then have *unobserved heterogeneity*. A way to see this unobserved heterogeneity, which regulates both processes, is to consider that in reality another process regulates both, as an effect of *preformation*. Huinink (2001) assesses that possible factors of preformation can be the level of education or stable social norms and orientation internalised during adolescence and having effects on family and work behaviour. All of these factors can produce heterogeneity governing many choices of individuals.

This idea of unobserved heterogeneity is coherent with the ideational approach, which underlines heterogeneity in preferences of individuals as a result of different ways of conbining individual orientation with norms prescribed by the society as a whole.

As a result of the presence of unobserved factors, the effects of a covariate on the hazard rate will be confounded with the effects of the dependent process on the values of the covariate, and so the effect of the covariate may be completely spurious, as Yamaguchi (1991) underlines.

Even when we consider only one process, the presence of unobserved population heterogeneity causes some problem: we either overestimate a negative duration effect or underestimate a positive duration effect. In fact, if the unobserved factors make the hazard rate of having an event is high for some persons, they will experience the event and leave the risk set earlier, on average, than others, controlling for covariates that are included in the model.

Therefore, the duration effect becomes confounded with the selection effect such that, controlling for covariates, the average hazard rate of experiencing the event among persons who are at risk becomes smaller as duration increases.

The most well-known example (reported for example in Blossfeld and Hamerle, 1992) of this deals with the simplest case of two sup-populations, each of them having a constant rate of experiencing some event. If this information is not considered, and the population is treated as a whole, then the hazard tends to exhibit negative time dependence, *i.e.* a decreasing hazard rate.

2. Dealing with Interdependent Subprocesses: Different Approaches

From the point of view of the event history approach, three alternatives have been discussed in the literature: *system approach*, *causal approach* and *simultaneous equation approach*.

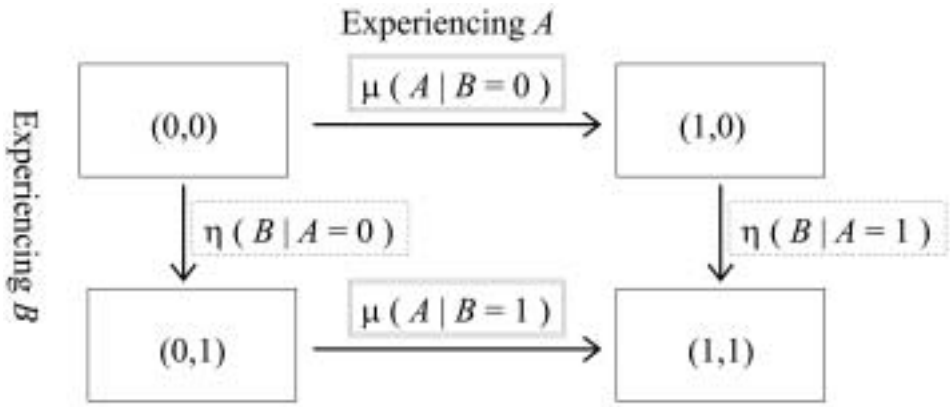
1. The System Approach

The *system approach* (also called *interaction model* in Courgeau, 2000) was developed mainly by Tuma and Hannan (1984) and Courgeau and Lelièvre (1992), following the main idea that, to analyse interactions between sub processes, the conditional distributions of one event on the occurrence/non-occurrence of the other (and vice versa) have to be compared. In case of two events, the situation can be represented as in Figure 38.

To assess if dependence is occurring and if it is 'unilateral' or 'reciprocal' (which in Courgeau and Lelièvre, 1992, corresponds to asymmetric and reverse causation), an equality test between the before- and after-instantaneous failure rates has to be performed. In Figure 38, for instance, testing equality of $\mu(A|B = 0)$ and $\mu(A|B = 1)$ means to assess that the way of experiencing A does not depend on B, while reciprocal independence is assured if both $\mu(A|B = 0)$ is equal to $\mu(A|B = 1)$, and $\eta(B|A = 0)$ is equal to $\eta(B|A = 1)$.

This strategy implies that if k events are taken into account, 2^k will be the failure rate to compare, two by two. Therefore the state space is redefined, and the new state space is derived from the various state spaces of the coupled qualitative processes.

Figure 38. A representation of system approach



The main drawback, of this approach is that it does not directly estimate the effects of couple processes under study. The unanswered question is 'to what extent do one or more of other processes affect the process of interest' (Blossfeld and Mills, 2001).
Moreover, this approach 'is unable to handle interdependencies between coupled processes occurring in specific phases of the process or interdependency that is dynamic over time.' (*ibidem*). (Consider for example the case in which the relation between variables depends also on when the second event occurs.)
Finally, since the number of hazard functions which have to be compared increases strongly with the number of events, complexity soon arises.

2. The Causal Approach

A different approach, called namely the *causal approach*, has been proposed by Blossfeld and Rohwer (1995). The main idea is to focus on one of the interdependent processes and consider it as the dependent one. Then the current rate of the latter process is supposed to depend on the entire previous history of other processes and of itself, and on other covariates.
This hypothesis is valid if and only if 'we consider here only interdependent processes that are not just an expression of another underlying process, so that it is meaningful to assess the properties of the two processes without regarding the underlying one' (Blossfeld and Mills, 2001).
Again, the *principle of conditional independence* for parallel and interdependent process assesses that: 'Given two parallel processes, $Y_{A,t}$ and $Y_{B,t}$, a change in $Y_{A,t}$ at any (specific) point in time *t'* may depend on the history of both processes up to, but not including *t'*. Or stated in another way: what happens with $Y_{A,t}$ at any point in time *t'* is conditionally independent of what happens with $Y_{B,t}$ at *t'*, conditional on the history of the joint process $Y_t = (Y_{A,t}, Y_{B,t})$ up to, but not including *t'*.' (*ibidem*).

What are the consequences? If we consider all interdependent processes describing the risk of experiencing each of them as a function of the others and of past history, then the likelihood for these processes can be factorized into a product of the likelihood for the separate models. Moreover all time dependent covariates (defined, ancillary and internal) can be equally treated in the estimation procedure.
Again, we underline that the main hypothesis of this model is that we are not dealing with endogenous processes, while conditional independence holds.

3. The Simultaneous Equation Approach

In contrast to this postulate, the *simultaneous equation approach*, has developed from the idea of endogeneity. Since in fact a key feature of the life course paradigm is that trajectories are our main interest instead of simple transitions, and that different processes may in turn be the expression of the same one, underlying all of them, the previous approach is no longer useful.
A simple example reported in the demographic literature (Upchurch *et al.*, 1995) concerns the interrelation between marriage, fertility and schooling. On the one hand, in fact, for women marriage may increase the chance of dropping school and having a baby, since the conditions (costs and opportunities) after marriage change and it is more difficult to continue to invest in human capital. On the other hand, maybe women married because they were no longer interested in human capital investment, and this made them more prone to be involved in family formation activities. In both cases, the two processes are interrelated and something is common in the two decisions. This component may be described as a woman specific characteristic, coming from 'tastes, preferences, attitudes, abilities and so on, which are not measured' (Upchurch *et al.*, 1995).
Since endogeneity cannot be explained by manifest variables in the equations, a component of unobserved is added in each process, and correlation across these components is allowed.
Also this model has some drawback, as the fact that (as we said before) in certain cases duration dependency may not be separable by the presence of unobserved heterogeneity components (known in the literature as *identifiability issue*).

In summary, we presented here three distinct approaches: the first, considers comparison of the conditional risks of one event given the other for assessing independence, but it is not feasible when we are taking into account many events together; the second and the third are similar to each other, as the third is an extension of the second (although conceptually there is a great difference). For this reason, in the following section we present a particular way of considering interdependent processes, *i.e.* a simultaneous equation model where the unobserved heterogeneity component has a normal distribution, additive in the log-hazard. This model belongs to the class of Mixed Proportional Hazard models (MPH models), useful when we hypothesise the existence of an unobserved heterogeneity component.

D. Simultaneous Equation Models as a Particular Choice

In this Section we focus on the approach which explicitly includes the existence of unobserved heterogeneity and to the particular kind of models proposed by Lillard and colleagues (Lillard, 1993; Lillard and Waite, 1993; Lillard *et al.*, 1994; Panis *et al.*, 1996; Brien *et al.*, 1999; Upchurch *et al.*, 2002). These models are becoming quite widespread, due to their high level of flexibility and multiple features, which are evident reviewing some applications where they have been employed.

As we underlined above, with simultaneous equation models we are able to consider more than one event at the same time, allowing the existence of inverse causation. Moreover, we may distinguish among state dependence and rate dependence. In Lillard (1993) for example, where marriage dissolution and fertility timing are studied, it is supposed that the rate of marriage dissolution only depends on the *state* of prior outcomes of the joint process (*i.e.* on presence of marital conception, distinguishing on conception in the current or previous marriage or out of wedlock), while the rate of a new conception depends on the *rate* of (potential) marital dissolution (women at high risk of splitting up may reduce their willingness to conceiving), and it is considered in building the model.

The second important aspect is that we explicitly introduce an unobserved heterogeneity component in the model. This allows us to understand if heterogeneity components are significant for each process and to evaluate the kind of correlation induced by unmeasured factors across different processes. For example Brien *et al.* (1999) studied the relationship between marriage, cohabitation and non-marital conception, and found significant positive correlation across unobserved factors. This means that people who (for reasons that we do not measure) are especially likely to follow one path to family formation may be especially likely (for the same unmeasured reasons) either to follow or to avoid another path (likely, if someone is ready for forming a family, he/she is ready for cohabitation, marriage and parenthood).

Moreover, in the model it is possible to distinguish when a covariate has a direct effect on another variable and when the effect is only due to unobserved factors. Studying the role of health in marriage, it is important to distinguish whether marriage has a direct positive effect and thus improves health and/or reduces the risk of mortality (and so it may be that individuals in poor health have an incentive to actively seek a partner), or whether the differentials reflect a positive selection of healthier individuals into marriage (healthy individuals may be more attractive than individuals in poor health). Lillard and Panis (1996) found that positive selection into marriage is based on unmeasured factors, while adverse selection is based on self-perceived general health.

All these interesting features are peculiarities of the model under study. Therefore, it is useful to present a general analytic description and then to consider the estimate procedure. Finally, a short hint toward the drawbacks of this kind of models follows.

1. An Analytical Description

In general, to set up a model we have to start from a theoretical framework, which gives us ideas on how events are interrelated and which hypotheses we need to test. We describe the risk of experiencing each occurrence of the event (events are in principle repeatable), through a hazard equation, here exemplified as a continuous-time failure-time process. This equation describes the probability that an occurrence of the event will take place at time *t*, conditional on its not yet having occurred, and incorporates various forms of time-varying covariates (some of which may be endogenous) as well as individual heterogeneity. Consider that we are studying two events, *q* and *r*, where the log-hazard at time *t* for the episode *e* of process *p* (where *p* stands for *q* or *r*) is:

$\ln(h_e^p) = \alpha_{p0} + \alpha'_{p1}\, T(t) + \alpha'_{p2}\, X_p(t) + \alpha'_{p3}\, Y_p(t) + \varepsilon_p$, where $\varepsilon_p \sim N(0,\sigma^2)$**.** (The subscript for an individual - say, *i* - is suppressed for notational simplicity.)

Each of these equations includes both a predicted part, depending on time-varying measured covariates, and a residual part, reflecting the effects of person-specific unmeasured factors that influence the probability of experiencing the event under study. $T(t)$ represents the sum of all forms of duration dependence, including any endogenous durations. Indeed, according to Vermunt (1997), hazard rates may be related to different kinds of time dimension, such as calendar time, duration and experience (it is what Lillard, 1993, calls 'multiple clocks'). Generally the time variable has not a direct causal effect on the hazard rate, but time dependence is the result of unobserved factors which change in some systematic way together with the time dimension involved. All these considerations show us that the operationalization of the time dependency and the interpretation of its effect need attention in setting up the models. In the model proposed by Lillard all duration dependencies are captured in piecewise-linear spline transformation of time, so that their sum, again, is a piecewise-linear spline.

The vector $X_p(t)$ represents exogenous covariates, while $Y_p(t)$ represents endogenous ones. When we deal with endogenous covariates, we can distinguish the kind of effect of inverse causation introducing covariates in two different ways: if we think that the dependent process depends only on the states of the covariate process, we have to introduce a time varying variable representing the *prior* outcomes of the joint process. Otherwise if the risk or hazard rate associated with one process has a direct effect on the occurrence and timing of another event, *i.e.*, on the hazard rate of another process, we introduce the hazard rate of the joint process as a covariate. In the latter case, the explanatory hazard rate is a latent variable and not directly observable. Thus, we have to substitute the modelled form instead of latent log hazard of the covariate into the equation to obtain the reduced form hazard equations.

ε_p refers to unobserved heterogeneity components, and if we jointly consider the two events (namely: *q*, *r*) these unobserved residual components may be correlated. We assume joint normality of these residual terms in the log hazard equations, so that we have

$$\begin{pmatrix} \varepsilon_q \\ \varepsilon_r \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_q^2 & \sigma_{r,q} \\ \sigma_{r,q} & \sigma_r^2 \end{pmatrix} \right)$$

2. How to Estimate Model Parameters

In order to estimate model parameters, we must first build the joint likelihood function and then maximise it. We will develop it step by step.

For any given person, conditionally on measured covariates and on his/her vector of heterogeneity components (as if they were known), the outcomes of each episode of each process are independent both within and across processes; thus the joint conditional probability of all outcomes is the product of the conditional probabilities of the individual outcomes. Each independent conditional probability is termed a *conditional likelihood*; the product is termed *joint conditional likelihood*. The heterogeneity components, however, are not known, and they are nuisance parameters that must be integrated out. In other words the likelihood is a weighted average of all possible conditional likelihoods, where the weights are dictated by the distribution of the heterogeneity components. The result is the *marginal likelihood* of the observed outcomes. This is the likelihood to be maximised.

While the marginal likelihood equations above are specified for each type of observation, the aggregate likelihood equation is the product of the individual likelihood functions over all the observations.

Parameters are estimated jointly, using the maximum likelihood method. The heterogeneity components are integrated out numerically (for more details see Lillard and Panis, 2000).

3. A hint of Identification Issue

A key feature of this model is its ability to take into account the interaction between processes caused by the presence of endogenous covariates.

Unfortunately, together with this ability, we have some drawbacks. The first concerns what is known in the literature as an *identifiability issue*, and is solved under certain conditions. For instance, if we only consider repeatable processes, in which the events are (at least theoretically) experienced more than once by individuals, identifiability is assured. Moreover, in case we are dealing with interdependent processes, it is enough to describe each of them through different covariates, *i.e.* include in one equation some covariate which significantly affect one process but do not directly affect the other one.

Many examples are provided in the literature, such as in Lillard (1993), Lillard and Panis (1996), Brien *et al.* (1999), Lillard and Waite (1993).

The other drawback is that not much is actually known about the properties and the robustness of maximum likelihood estimators in such models.

E. Discussion

In this Appendix, we basically discussed how to perform the explanation of a social phenomenon. Therefore, we started presenting the general concept of causation, emphasising the need to combine both theoretical arguments and methodological (statistical) tools.

Thus, we devoted one Section to the presentation of general frameworks which can help in formulating hypotheses. We mentioned the widespread rational choice model and the cognitive rational model; we briefly presented the structural approach and finally the ideational model. All these different approaches provide some clue to understand the mechanisms which link some specific input to some specific output. In our view, they do not have to be considered as contrasting, rather compatible: conceptual models can not avoid to simultaneously consider both structural elements, variables representing the social context and even cultural elements.

The following Section shifted attention to the methodological tool we employ to test hypotheses, specifically event history models. Also in this case the literature presents different approaches, such as the system approach, the causal approach and the simultaneous equation approach. Since the latter is the only one which explicitly takes into account the existence of some unobserved heterogeneity component, we presented it in detail, showing its main features (flexibility) and emphasising its drawbacks.

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